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REMARKABLE REPORT ON THE COST OF INCANDESCENT ELECTRIC LIGHTING.

Herewith is given the gist of a report to the American Electric Light Company, by Mr. E. P. Roberts, on the cost of incandesent electric lighting—

"I calculate that we can, merely allowing equal illumination, and not taking into account the immense advantages of incandescent lighting, compete with gas at 96 cents per M.

"The following is the data from which I have obtained the above result—

"Take a 500-H.P. engine—cylinder 26×45; pressure by gauge, 75 lbs.; revolutions, 100; pressure absolute, 90 lbs.; 25 per cent. cylinder condensation; assuming 7.65 lbs. of water evaporated per pound of coal; coal $4.25 per ton of 2,000 lbs.; clearance 2½ per cent.

Cost of engine, $9,000. Cost of boiler, $8,500	
Interest on cost of engine, per hour	.062
" " boiler "	.059
Repairs to engine, "	.018
" boiler, "	.023
Depreciation of engine, life 25 years	.042
" boiler, " 12 years	.082
Oil and waste	.062
Wages of engineer	.400
" fireman and coal passer	.350
Cost of coal	4.184
Total	$5.282

This engine develops economically 502-H.P., when expanding 3.4 times. Cost of 1-H.P. per hour, $.015.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

"The following is an estimate of the cost of a plant of thirty 100-light machines, to be run by the above mentioned 500 H.P. engine and boiler. Each H.P. to run six 16 candle power lamps, or 96 candle power, giving a total of 48,000 candle power.

"First cost of electrical plant—

Cost 30 machines @ $600	$18,000
" 3000 lamps @1.25	3,750
" 20 miles of main @ $3,500	70,000
" laying " @ $1,800	36,000
Shafting, pulleys, tools, fittings, testing apprratus, etc	3,000
Capital	$130,750
Interest on $130,750 @ 6 per cent	7,845.00
Salary one electrician	1,500.00
" two assistant electricians	1,200.00
" one helper	500.00
12,000 renewals @ 15 cents	1,800.00
Rent	2,500.00
Repairs @ 10 per cent. on $130,750	13,075.00
Depreciation @ 10 per cent	13,075.00
	$41,495.00

To run 30 machines 10 hours per day, cost per hour	11.37
" 1 " " " "	.379
" 1 light " " "	.00379
" 6 " " " "	.0227
Giving the electrical cost of 6 lights, each 16 C.P.	.0227
Cost horse power for same	.0105
Total	.0332

"The same illumination with 18 candle power gas, would cost .0331 at 96 cents per thousand."

REMARKS.

The above is given as showing from what false premises conclusions are reached when the public is asked for means to carry on what must prove, from the author's own data and admissions, an unprofitable enterprise.

The writer displays an inexcusable or willful ignorance of the conditions that obtain in the use of illuminating agents by estimating that an electrical plant, with a maximum capactity of 48,000 candles light per hour, is going to deliver to its customers this amount of light for ten hours in each and every day in the year. This never happens; but this is the false but convenient basis by which comparison is made with a gas plant. When the conditions under which light is actually used are considered it becomes evident that nearly all of the writer's items of cost have to be more than trebled.

Not only so, but the cost of plant and working are underestimated, the low figures made cannot be substantiated by the data of any practical working. The delivery of candle power per horse power is overestimated as, in practice, it is doubtful if the delivery to the consumer of the equivalent, in all respects, of 50 candles in gas per horse power has been reached where the incandescent lamps are of 16 candle power, nominal. Moreover, in the above estimate, many of the serious items of cost, necessary to the distribution of every illuminating agent, have been entirely neglected.

From such a writer blunders and misstatements may be looked for; but when, to advantage his argument, he overstates by 30 per ct. the cost of the light of 96 candles from 18 candle gas at 96 cents per thousand cubic feet, he trespasses on the credulity of the general public and causes engineers to mistrust every other statement in his report. It was not convenient to the argument to state that an electrical lighting for three and three-tenth cents gave the light of 96 candles, whereas, with 18 candle gas, 26.6 cubic feet would be required to give a light of 96 candles which, at 96 cents per M, would cost 2.55 cents, and not 3.31 cents.

The admissions in the report confirm the information already obtained that the interest alone, at ten per cent. on the capital required in such an electrical plant as estimated for, would entirely cover the present charge for gas to the consumer in many of our cities. To this charge, in incandescent electrical lighting, must be added the cost of coal, not less than twice as much, per candle of light for so-called 16-candle power incandescent lamps, as for gas, and all the other items entering into the cost of manufacture and distribution. The total cost to the user of electric lights instead of three and three-tenth cents for the light of 96 candles must be much more if the stockholders in an electric light company are to receive any interest returns for their investment from supplying the public with light.

[Official Report.]

New England Association of Gas Engineers.

At a special meeting of the Association, held at the Massasoit House, Springfield, Mass., February 2d, 1882, on the occasion of the funeral of George Dwight, late a member of the Association, and one of its founders.

Voted—That the reading of the minutes of the last meeting be dispensed with.

The President, Mr. W. A. Stedman, of Newport, R. I., in a brief address announced to the members the sad occasion of the meeting, and alluded with deep feeling to the great loss sustained by the Fraternity, and by all those connected with Mr. Dwight by family ties or by business or social relations, and suggested the appointment of a Committee to prepare and present to the next annual meeting suitable resolutions of respect to the memory of their late associate, and sympathy for those who have experienced such a great loss in his death.

Voted—That a committee of five, of which the President of the Association should be one, be appointed by the Chair for that purpose.

The Chair appointed Messrs. William W. Greenough, Boston, Mass.; George D. Cabot, Lawrence, Mass.; Samuel G. Stiness, Pawtucket, R. I.; William A. Stedman, Newport, R. I.; F. C. Sherman, New Haven, Conn.

Voted—That suitable resolutions of the same character suggested by the death of Charles S. Colbath, late Superintendent of the North Attleboro gas light company, be drawn up for presentation at the next annual meeting by a committee of three to be appointed by the Chair.

The Chair appointed, as that committee, Messrs. Samuel G. Stiness, Pawtucket, R. I.; J. H. Rollins, Worcester, Mass.; J. F. Rogers, Jamaica Plain, Mass.

Voted—That the Association attend, in a body, the funeral of their late associate and friend, George Dwight, at two and a-half o'clock this afternoon.

Voted—To adjourn.

Geo. B. Neal,
Secretary.

Springfield, Feb. 2, 1882.

[Communicated Article.]

The Relative Economy of Naphtha and Cannel as Enrichers.

By Eta.

The improvements which have been made during the last few years in the mode of carbonizing coal and condensing gas have been such as to make the use of any enricher for the ordinary coal gas, in a large number of instances, unnecessary. Thus many gas companies which a few years ago used five or ten per cent. of cannel coal with their caking coal, now supply as rich a gas as they were wont to do without the use of any cannel, excepting during the winter months. Another change has come about recently, namely, many companies who do use an enricher now employ oil in lieu of cannel under the impression that the former material is the cheaper. It will, therefore, be of interest to endeavor to ascertain if this impression be a valid one—if oil is in reality more economical for the purpose intimated than cannel coal.

Now, at first sight, it would seem that the question could be very quickly answered; that for a fixed sum of money a certain quantity of oil or cannel can be obtained, and the amount and quality of the gas they will produce being known, their relative cheapness could be very quickly demonstrated. Putting it broadly this reasoning is correct; but it is too broad for our present purpose, for there are several other factors which must be taken into account, such as labor, fuel and residuals.

We will place the price of naphtha at six cents a gallon, this producing 60 feet of 60 candle gas, and assume the cannel to be delivered in the shed for $8.60 per ton of 2240 lbs., the yield being 11,424 feet of 45 candle gas. Comparing the two materials we could say that in the case of oil for 6 cents we could procure $60 \times 60 = 3{,}600$ candle feet. and the same sum will obtain 15.61 pounds of cannel giving $79.6 \times 45 = 3{,}582$ candle feet. We must now take up the other factors. It will facilitate the comparison to reduce the gallons to pounds; and as the weight of a gallon of naphtha may be safely placed at 7 pounds, we will have, as the price of that material, six-sevenths of a cent per pound, producing 8.6 feet of gas, or 516 candle feet. Let us now suppose that we have 14 candle gas which we desire to raise to 17.5, or by 3.5 candles. If this enriching is done with cannel we will have, as the composition of 1,000 feet of the mixed gas, the following product—

113	feet of cannel gas of	45	candle power.....	5,085
887	"	" 14	"	12,418
1000				17,503

and 17,503÷1000=17.5 candle power.

The cost of producing this 113 feet of enriching gas will be as follows—

	Cents.
22.1 pounds of cannel @ $8.60 per ton.....	8.4
Breaking and wheeling coal @ 25 cents per ton.....	0.24
Stoker's wages @ $2.25 a day.....	0.85
Wear and tear of retorts @ 4 cents per M. feet.....	0.45
Purification @ three cents per M. feet.....	0.34
	10.28
Less—	
Coke .18 bushels @ 4 cents per bushel.....	0.72
Tar .10 gallons @ three cents per gallon.....	0.30
Ammoniacal liquor 2 gallons @ ½ cent per gallon.	0.10
	1.12
Net cost enriching 1000 ft. of gas from 14 to 17.5.	9.16

Stoker's wages in above figured on a basis of 5,850 lbs. of coal charged a day per man. We allow that 31 bushels of coke are obtained per ton of cannel, and that 40 per cent. is used in carbonizing the same. Tar, 10½ gallons, and ammoniacal liquor, 20 gallons per ton of cannel. To produce the same quality (17.5 candle power) of gas from the 60 candle power oil gas and the staple 14 candle coal gas, we must mix the gases in the proportion of 75 feet of the former to 887 feet of the latter as, obviously, to have the comparison a just one, we must take only the same number of feet of the poorer gas in each case. We then have, as the composition of the naphtha enriched gas the following—

				Product.
75	feet of 60 candle gas....		.....	4,500
887	"	14	"	12,418
962				16,918

and 16,918÷962=17.5 candle power. That is, we have 962 feet of 17.5 candle gas. We have now to ascertain the cost of producing the 75 feet of naphtha gas which will be as follows—

	Cents.
8.77 lbs. of naphtha at 6.7 of a cent a lb. (1¼ gals. at 6 cents).	07.5
Coke .26 bushels at 6 cents.....	01.56
Wear and tear of retorts at 4 cents per M. cubic feet.....	00.45
Labor at $2.25 per day.....	00.24
Cost of enriching 962 ft. of gas from 14 to 17.5 candles.....	9.75

Then the cost per thousand feet would be $975 \times 1000 \div 962 = 10.1$ cents.

The coke for distilling the oil gas is figured at 3½ bushels per M. feet of gas made. In labor allow a make of 70,000 feet per man. From the foregoing it appears that to raise 14 candle gas to 17.5 costs—

When naphtha is the enricher, 10.1 cents per M. feet.
" cannel " " 9.16 " "

Difference in favor of cannel, .94, or not quite one cent. Perhaps, to the estimate on the naphtha gas we should have added interest on plant, such as a special oil gas bench, tank, etc. If we had included this item it would probably have added one-third of a cent to the cost of the naphtha-enriched gas.

So far we have considered that the oil gas is generated in a separate bench from the coal gas. This, however, is not the universal practice; but we do not think it necessary to consider at length the various ways in which it is sought to make oil gas in the coal gas benches, because all such expedients are merely makeshifts, and far more extravagant than the mode we have considered above. Thus, if we attempt to generate oil gas by allowing the oil to run through a pipe, open at the rear end, placed in the bottom retort, or if the oil be dropped into the retort through an opening in the mouthpiece, or if the last shovelful of coal be saturated with oil, and placed just back of the mouthpiece, there is in each case a waste of material, either through having too low or too high a heat, that will more than offset any saving in labor or fuel. It would, therefore, appear that, at the present price of cannel and oil, the former is the cheaper enricher.

Condensation and Hot Scrubbing.

A paper read before the Society of Gas Lighting, January 26, 1882,

By F. C. Sherman, Engineer New Haven Gas Company.

The *Journal of Gas Lighting* of January 3, 1882, in a retrospect of the year 1881, in summing up the inventions and improvements for the year in our business, says: "The principle of fractional or hot condensation of gas has also assumed the proportions of an accepted rule of gas-works practice during the year."

Some six years since, on the bringing out of the Aitken & Young process, the subject received considerable attention at the meetings of the West of Scotland Association of Gas Managers, and also at the meetings of the North British Association. For the last two years, as far as I have observed, the subject of this paper has received very slight notice in the literature of our business, and it was with some surprise I read the paragraph that heads this paper.

As far back as 1867, the Rev. Mr. Bowditch, in his work on Coal Gas, expounded what appears to me to be the true theory of condensation; but up to the present time so little interest has been taken in this matter that the mechanical difficulties in the way have not been overcome. Several patents have been taken out in England and in this country for apparatus intended to do this work; but none of them have so far commended themselves to the managers of gas works as to come into general use. I have drawings representing the Aitken & Young analyzer, the Smith & Sayre Manufacturing Company's hot scrubber, and Smith & Farmer's zigzag scrubber and hot condenser.

The common practice in regard to condensation in this country is to bring the gas down to the temperature of the atmosphere in the quickest possible time. In many instances the gas from the hydraulic main is taken at once to the multitubular condensers, and there reduced in temperature from 100° to 54° immediately.

Mr. Bowditch, on page 3, says of this system of condensation: "There could be no more mistaken practice than the one commonly adopted, for it is in the power of most engineers to make a considerable difference in the illuminating power of all the gas they manufacture, by the adoption of a better mode of condensation. The increased illuminating power obtained by a superior method of condensation is obtained almost without cost for material; whereas, when gas is improved by the use of cannel coal, the cost for material is considerable. Hitherto principles of science seem to have had but little connection with condensation. The proper object of condensation is the removal from gas of substances produced in the distillation, which for some reason are not useful for the purpose of illumination, and the retention in the gas of all the substances which are useful as illuminants and can be distributed with the gas."

He says: "When coal is put into retorts for distillation it contains water, and a considerable quantity of additional water is *formed* during distillation. This water takes up ammonia, sulphuretted hydrogen, carbonic acid, cyanogen, etc., and also a part of the volatile light-giving hydrocarbons to which coal gas owes much of its luminosity. Water, and most of the compounds which the water holds in solution, are useless, and cannot be distributed with the gas. These, therefore, should be removed. The heaviest hydrocarbons (tar) are useful as illuminants, but cannot be distributed with the gas, and therefore they should be removed. But the gases and the lighter hydrocarbon vapors are useful, and can be distributed; and therefore no more of these should be taken out than is absolutely necessary to effect a proper removal of the compounds which must be removed, because they are useless as light givers or cannot be distributed. Of all substances, the most useful as light givers, when burned with gas, are the vapors of hydrocarbons, and therefore every pains should be taken to keep in the gas the largest possible quantity of these vapors." He says: "Most manufacturers of gas take the best means with which we are acquainted for removing hydrocarbon vapors from gas. They cool their gas and hydrocarbon vapors down to 60° or 70° F. (and in some cases lower), as quickly as they can, and the form of condenser which will do this most quickly and certainly is the one generally preferred. No suspicion seems to cross their minds that they are enabling the tar (that is, the heavier oils) to dissolve out from the gas, and carry down with it the vapors of light hydrocarbons which they ought to retain in their gas with the utmost sedulity."

Giving his own experience, he speaks first of the light hydrocarbons known as coal naphtha. These, he says, "have been obtained by the distillation of gas tar, and consequently have been separated from gas by the process of condensation now used in our gas works. If gas be passed over this naphtha, it gradually disappears, and the gas which passes over the naphtha acquires considerably greater illuminating power than it possessed before its passage over the naphtha."

Then, speaking from the experiments made by Dr. Letheby in the City of London Laboratory, he states that four grains of naphtha added to a cubic foot of common London gas increased its illuminating power 25 per cent.; and 10.77 grains added to a cubic foot of the same gas increased its illuminating power 77 per cent. Mr. Bowditch then adds: "I never yet saw common gas which would not take up and carry during its distribution four or more grains per foot of suitable hydrocarbon vapor. This simple experiment shows, first, the illuminating value of the naphtha which was removed from the gas during the manufacturing process; and secondly, the power of the gas to take up and transport so much of the naphtha as to acquire considerably greater illuminating value when the naphtha is presented to it alone, without the presence of any other substance which acts antagonistically to the gas."

He says: "It may be objected by some persons that heavy oils cannot be carried by gas. This is a mistake. I have obtained from the gas supplied to my house a quantity of oil so heavy (that is, of such high boiling point) that a Florence flask in which it was distilled softened and partially lost its shape before the oil could be driven over. I have likewise passed gas at common atmospheric temperatures over hydrocarbon oils boiling from 220° to 280° F., and the whole was taken up. So that in any inquiry as to the power of gas to take up and carry the hydrocarbons that form tar, we must not confine our view merely to benzole and other hydrocarbons of still lower boiling point, but must extend it at least to those which boil as high as 400°. Benzole will boil and pass away as vapor at 176° F. It seems obvious, then, that if we wish to keep the vapor of benzole in gas, we ought to keep all the substances produced in distillation at a temperature slightly above 176° F. and below 395° F. It seems as obvious that if the whole products of the distillation are cooled down quickly to 60° F. or 70° F., all or nearly all the substances condensable at that temperature will be condensed and removed from the gas."

He goes on to say: "The hydraulic main ought to be at a proper temperature, and to be prolonged sufficiently to allow the less volatile bodies to condense and pass away to the tar well, and the more volatile to go forward with the gas; or, what is much better, a special apparatus kept at a regulated temperature should be interposed between the hydraulic main (in this case kept hot, of course,) and the purifying apparatus, in which the gas and lighter hydrocarbons might be separated from the heavier bodies, and so a large proportion of hydrocarbon vapors be distributed with the gas—in other words, the gas made more illuminating.

"Gas," he says, "at common temperatures, can take up and carry a considerable quantity of the vapors of the lighter hydrocarbons if they be brought in contact with it after having been separated from the heavy ones; but the power of the heavy to carry down the light is greater than that of gas to carry them on; and hence all fall together in the present system of condensation, to the great detriment of the gas. I have passed gas through heated heavy coal oil boiling at about 400° F., and found its illuminating power identical with its illuminating power before it passed through the oils. It gave up nothing to them; it took nothing from them. I have also passed gas through the same kind of oil at ordinary temperatures, and have found its illuminating power reduced to less than one candle for a consumption of five feet an hour; whereas, before passing the gas through the oil, it had an illuminating power of 13 candles. The coal oil had dissolved out of the gas nearly all of its illuminating matter. In the present method of condensation this is imitated in a great measure. All the oils, the water, and the gas are cooled together, and thus an opportunity is afforded to the heavy oils to dissolve out the light ones from the gas; whereas the heavy oils should have been condensed first at such a temperature that they would not damage the gas, and the lighter vapors should have been cooled to the temperature proper for purification."

In regard to the effect upon naphthaline which this method of condensation would have, Mr. Bowditch says: "It would tend to lessen the deposition of naphthaline in gas mains. It is well known that deposition cannot occur at ordinary temperatures in the presence of a considerable quantity of the vapors of the lighter hydrocarbons. It seems probable, therefore, that the presence in gas of as much hydrocarbon vapor as the suggested process would keep in it, would enable it to uphold its naphthaline in a state of vapor by diminishing the tendency of the naphthaline to crystallize. The heavier compounds which form tar have a strong affinity for naphthaline at high temperatures, and as they condense are apt to carry down the naphthaline with them."

In the extracts I have given from Mr. Bowditch he shows that the proper method of condensation consists in keeping the gas and tar in the hot condenser at a temperature of not less than 176° F., and separating the heavy hydrocarbons from the lighter ones as soon as possible. No attempt seems to have been made to carry out Mr. Bowditch's recommendations until 1874, when Mr. William Farmer brought out his zigzag condenser; and in the autumn of that year it was adopted by the New Haven Gas Works. It is not necessary for me to describe it. It is really a tar scrubber, through which the gas is passed in such a manner as to produce the most thorough contact between it and the tar that is possible. This scrubber was put in a

building adjoining the retort house. The space between it and the hydraulic main was four feet. The gas entered it at 130° F. This scrubber accomplished most fully the purpose for which it was recommended; that is, it removed the naphthaline from the gas by keeping it in contact with tar. The gas was brought in contact with 600 feet of iron plates surface-coated with tar. The action of the tar at this temperature was to absorb the naphthaline vapors and carry them forward to the tar well. The tar from the hydraulic main did not enter the zigzag scrubber. The gas in the zigzag scrubber only came in contact with the tar carried over in vapor from the hydraulic main.

In working without dip-seal, as is the practice at the New Haven Gas Works, it is found that about two-thirds of the tar is collected from the zigzag scrubber, the other third being collected from the hydraulic main. There has been no perceptible gain or loss in the illuminating power of the gas at the New Haven works from the use of this scrubber. By its use the New Haven works were relieved in a great measure from the annoyance resulting from services and mains being stopped up with naphthaline.

In the zigzag scrubbers subsequently erected by Mr. Farmer he has carried out Mr. Bowditch's recommendations by adding a steam coil to his scrubbers, by which the temperature can be kept up to the degree of volatilizing the lighter hydrocarbons.

In the report of the proceedings of the ninth annual meeting of the American Gas Light Association, (Am. Gas Light Journal, Vol. 35, p. 244), Mr. Stedman, engineer of the Newport (R. I.) Gas Works, is reported as follows in speaking of naphthaline:

"I can honestly say that I think the application of the hot scrubber is a preventive of it in a very great measure. If I recollect rightly, the experiment of partially distilling tar from the hydraulic main in this scrubber (Farmer's zigzag), the distillation being effected by a coil in the bottom of the scrubber, commenced some time in May last. After we commenced doing this we did attain a very remarkable increase in the illuminating power of the gas. Before that we were using some 7 or 8 per cent. of cannel, and we reduced the quantity until we found it was entirely unnecessary to use any. Our record shows that during June, July, and August we used Kanawha coal alone, and kept up the full average of 18-candle gas, making from 5 to 5.1 feet per pound. But as regards the hot scrubber, I am satisfied it was a benefit to us, both in raising the candle power and in reducing the trouble we previously had from naphthaline."

In a note subsequently received from Mr. Stedman, in answer to some inquiries of mine, he says: "We use about two feet of heating surface in a coil in the bottom of the scrubber, and allow the contents of the hydraulic main to run into the scrubber and fall directly on the coil. I found this very beneficial in summer, but not of much account in winter."

Mr. Stedman does not mention the temperature maintained in the scrubber. His scrubber is located in the retort house, as near as possible to the hydraulic main. It is protected from cold draughts by some non-conducting material, which also prevents radiation. The error Mr. Stedman makes, in my estimation, is in allowing the contents of the hydraulic main to enter the hot scrubber. The contents of the hydraulic main should be carried to the tar well without passing through the scrubber, and only the lighter vapors should be subjected to the heat in the scrubber.

The Norwalk and the Bridgeport gas works in Conn., and the Citizens' works in Newark, N. J., have in operation hot scrubbers patented by the Smith & Sayre Manufacturing Company, of New York. This scrubber consists of a plain cylinder, say 6 × 14 feet, partially filled with perforated iron plates. In the bottom is a steam coil. The gas, the heavier and lighter oils or tar, and the ammonia liquor, enter this scrubber and there come in contact with the heated coil. The heated tars and ammoniacal liquor are raised by a steam pump to the top of the scrubber, and then allowed to trickle down through the perforated plates and come in contact with the gas entering from an opposite direction; that is, the gas enters from the bottom and passes off at the top of the scrubber.

At Bridgeport, Superintendent Gerdenier informed me that with a temperature of 171° F. (which is too low by 20°) he made a gas of 18.7-candle power from Westmoreland coal, without any enricher, and a yield per pound of little less than 5 feet. He also said that the complaints from naphthaline had ceased from the time of starting the hot scrubber.

At Norwalk the superintendent of the gas works claimed an increase of illuminating power and the absence of naphthaline crystals in mains and services since he began to use the hot scrubber. President Smalley, of the Citizens' work, Newark, N. J., claims a saving of cannel coal by the use of the hot scrubber. I was not informed in regard to the temperature maintained in the scrubbers at Norwalk or Newark.

In 1875 Messrs. Aitken and Young brought out and patented their hot condenser. Mr. Young has rendered great service to gas engineers by imparting to them so freely of his great chemical knowledge and experience. His apparatus, as described in the *Journal of Gas Lighting*, Vol. 25, page 805, is very similar to a Coffey still analyzer, consisting of an upright vessel having tray diaphragms placed at regular intervals, with openings at alternate sides, causing the gas to travel in a tortuous manner. Hanging from the lips of these trays are sheets of fine wire netting, dipping into the tars contained in the trays immediately underneath. This hot scrubber takes out the light naphtha vapors and sends them forward with the gas. It is claimed that there is one-third of a barrel of benzole in the tar produced from one ton of coal; and it is claimed that this quantity of benzole will raise the candle power 10 per cent. if distributed over 10,000 feet of gas. At the Hamilton works, Scotland, a gain of 20 per cent. in illuminating power was claimed by the use of this scrubber. In order to get the best results from this hot scrubber the temperature must be kept up to 220° F.

In the report of the West of Scotland Association of Gas Managers (*Journal of Gas Lighting*, Vol. 30, page 762), Mr. Aitken is reported as follows:

"The whole theory of the practice is keeping the tars and gases as much separated as possible; or, if they do come in contact, it is only at such temperatures as will prevent the heavy tars from carrying down with them the lighter hydrocarbons, which form, to a great extent, the light-giving portion of the gas."

The Lighting of Railroad Cars.

The recent railroad accident at Spuyten Duyvil, in which the subsequent burning of the cars was attributed in part to the oil employed in lighting directs especial attention to the different methods of illumination used, and their comparative safety.

The practice of the American public of reading while traveling has become very general; and while it helps to diminish the discomforts of a journey, it cannot be denied that the result is an injury to the eyes. This is true during the day time, but is more especially so when artificial illumination is employed, on account of the greater strain under which the eyes are placed. The use of candles, which is very general throughout the country, is objected to because of the insufficiency of the light which they give. The light is enough for all practical purposes, but is not enough for reading; and hence railroad companies have in many cases substituted oil. As a rule the oil used is safe, so far as the danger from explosion is concerned, and in some States the law fixes a standard for all illuminating oils used in lighting railroad cars. Rhode Island, for instance, has a standard of 300°, and the use of oil whose burning point is below this temperature is prohibited. The danger in employing oil, however, rests in the fact that in collisions the lamps are broken and the oil is scattered about, and, coming in contact with the fuel from stoves, adds greatly to the amount of combustible material. Burning oil, moreover, is more difficult to extinguish than the woodwork of the car. If steam were employed for heating, the use of oil would be attended with less serious results, as in case of collision the lamp flames would doubtless be extinguished, and the oil would not be ignited.

The coroner's jury, in their verdict on the recent disaster, express the opinion that the use of candles in lighting a car "is attended with less danger than oil, and that they answer all necessary purposes." This represents the exact state of the case; and the only question is, shall oil be used for the increased illumination, or candles for greater safety?

Of late years the experiment has been made of using illuminating gas in place of candles, and on many accounts the substitution seems to be a desirable one. It can be readily stored under pressure in iron cylinders, and distributed as desired. Each car could have its own supply, or a supply sufficient for the entire train could be furnished from a single storage reservoir, and carried from car to car by flexible tubes.

Gas has found a more extended employment on steamboats than in cars. Its use in the latter case necessitates a considerable original outlay for storage cylinders, pipes, burners, etc., besides the apparatus required for compressing the gas in the cylinders, which must be placed at points on the road where they will be most available for replenishing the supply.

Just now public attention is being directed to the lighting of cars by electricity. The experiment on the Brighton (Eng.) Railway will doubtless prove that incandescent electric lamps, supplied with currents by secondary batteries, form the safest means of lighting cars, but at the same time that the expense is greatly in excess of any other method. This obstacle may in time be overcome, in which event electricity is likely to become a common if not a general means of illumination for cars. In case of collision the incandescent electric lamps could not cause a fire, as the carbon filaments are destroyed the moment the glass bulbs are broken.

It appears therefore, that of the four methods of lighting, namely, by candles, oil, gas, and electricity, and with our present appliances for employing oil and gas, candles are the most practicable where safety is the first thing to be considered.—*Sanitary Engineer*,

[From the London "Journal of Gas Lighting."]

On the Purification of Gas by Ammonia.

By F. D. Marshall,
Engineer and Manager of the Danish Gas Company, Copenhagen.

As the formation of a Company (a prospectus of which appeared in your issue of Dec. 6th) for working the "Ammonia Soda" process in conjunction with gas manufacture appears to be a *fait accompli*, and as the objects of the Company are of universal interest, it may be worth while to consider more fully the details of the process.

In the first place, we may feel sure that the validity of the scheme will receive the fullest and most impartial consideration from Mr. G. Livesey; and, knowing this, one feels a little diffidence in remarking that the published results of the experiments by Prof. C. W. Heaton are not so full or exhaustive as could be desired, and have apparently only proved that carbonic acid and sulphuretted hydrogen are removable by crude ammonia.

It does not appear from the published statements whether the vital question of obtaining mono or bi carbonate of ammonia from ordinary gas scrubbers or washers, in a tolerably pure state, has been satisfactorily accomplished; for it must be admitted that on this depends the success of the scheme, at least the part of it that applies to the production of ammoniacal gas.

It may be recollected that this process formed the subject of a paper read by me before the British Association of Gas Managers in 1878, and it will be further remembered that, in the process described, it was proposed to employ a series of scrubbers or washers in which the gas is subjected to a process of "fractionation" or divisional scrubbing.

By "scrubbing," in the ordinary acceptation of the term, we imply the removal of impurities—such as ammonia, sulphuretted hydrogen, and carbonic acid—by water; and the resultant "liquor," charged with these impurities (both in the free and combined state), is collected in one common vessel or tank.

Now if we draw off and examine samples of the liquor taken from different heights in its passage down an ordinary scrubber, we should find that it contained the ammonia, sulphuretted hydrogen, and carbonic acid in varying degrees of combination; and we should further find that the liquor at the bottom contained a larger proportion of carbonic acid in combination than the liquor at the top of the apparatus. For the liquor, in descending, would absorb carbonic acid in preference to sulphuretted hydrogen, which would be continually expelled, and find its way to the top of the scrubber.

By the fractionation process it is proposed to make these reactions apparent, and, instead of using very tall scrubbers, it may be desirable to cut them transversely into sections, placing these sections side by side, and so converting a tall scrubber into a group of small ones, each one of the group having its own receiving tank.

Let us now imagine a series of these groups, numbered respectively 1, 2, 3, 4, 5, in which the gas passes through the series from 1 to 5, while the water or liquid is pumped from 5 to 1; so that by the time it arrives at group 1 it is converted into moderately strong liquor or a mixture of sulphide and carbonate of ammonia. This liquor is pumped up and down group No. 1 for some time, so that by contact with carbonic acid contained in the crude incoming gas, its sulphuretted hydrogen is displaced and pushed forward to groups Nos. 2 and 3, where it is absorbed as sulphide of ammonium. Ammoniacal gas obtained by a subsequent process is pumped into group No. 3, to absorb any free sulphuretted hydrogen and sulphur compounds pushed forward from groups Nos. 1 and 2.

On the contents of group No. 1 assuming the desired form of carbonate or bicarbonate of ammonia, they are withdrawn, and subjected to heat in a suitable vessel at a temperature of 180° F., and the ammonic carbonate is driven off in a vaporous form to be condensed in another vessel. The residual liquor, after the ammonic carbonate is driven off, is principally water containing a small quantity of carbonate and sulphocyanide of ammonium, and this may be introduced into the scrubbers.

So far the process may be continued in a gas works, but the following operations constitute the ammonia soda process, as at work on the Continent, and are preferably conducted in a separate establishment.

(*a.*) The concentrated ammonic carbonate is mixed in a suitable vessel with an equivalent of common salt (chloride of sodium, Na Cl)—

$$NH_4\,CO_2 + Na\,Cl = NH_4\,Cl + Na\,O_2\,CO_2$$

Chloride of ammonium and carbonate of soda are formed. The carbonate of soda being soluble would be difficult to obtain as such, but recourse is had to its conversion into an insoluble bicarbonate by an addition of an equivalent of carbonic acid. This carbonic acid in the first instance would be obtained from an extraneous source; but the bicarbonate of soda once formed is eventually heated, and the equivalent of carbonic acid given off is stored for future use. The bicarbonate of ammonia is separated from the chloride of ammonium by centrifugal force.

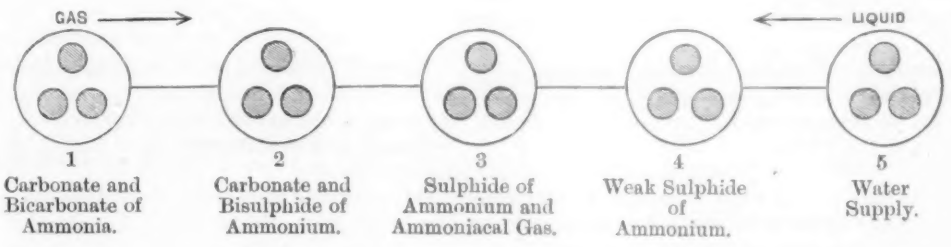
(*b.*) The ammonic chloride is then heated in a boiler with slaked lime, with the formation of ammoniacal gas, chloride of calcium, and water—

$$NH_4\,Cl + Ca\,O\,HO = NH_3 + Ca\,Cl + 2\,H_2\,O.$$

The calcium chloride, representing the whole of the lime used, is withdrawn in a soluble form, and may be afterward employed for sanitary purposes.

(*c.*) The ammoniacal gas liberated in the last operation is carried by pipes to the gas works, and is pumped back into group No. 3, as previously described.

In reviewing the process it is at once seen that the entire success of the scheme depends upon a carbonate, or preferably bicarbonate of ammonia in the first group; and the statements recently published do not refer to this, or say whether later experiments have been successful in displacing sulphuretted hydrogen from a mixture of sulphide and carbonate of ammonium such as gas liquor, and obtaining a tolerably pure carbonate of ammonia.



Referring to my figures and experiments published in the *Journal* of July 23, 1878, it will be seen that we employed scrubbers containing in the first group sulphide of ammonium, and in the second group caustic ammonia; and that by passing crude gas through the series the carbonic acid was absorbed by the sulphide of ammonium, while the sulphuretted hydrogen of the ammonic sulphide was displaced and pushed forward to be absorbed by the caustic ammonia in group No. 2. The composition of the ammonic sulphide was—

Ammonia.....	4.90 per cent.
Sulphuretted hydrogen	3.25 per cent.

and assuming the crude gas to contain 4 per cent. of carbonic acid, the theoretical quantity of gas to be passed to convert the sulphide of ammonium into monocarbonate of ammonia would be 39 cubic feet, or into bicarbonate 78 cubic feet.

In our first scrubber, originally containing sulphide of ammonium, we increased our ammonia from 4.9 to 6.89 per cent., and we also found 9 66 per cent. of carbonic acid absorbed.

To convert the 6.89 per cent. of ammonia into monocarbonate of ammonia, it would require 8.9 per cent. of carbonic acid, or a proportion of 22 of carbonic acid to 17 of ammonia; instead of which we have a proportion of 24 carbonic acid to 17 of ammonia, clearly proving the formation of a bicarbonate of ammonia and a thorough chemical expulsion of the sulphuretted hydrogen. For as sulphuretted hydrogen cannot exist along with sesquicarbonate or bicarbonate of ammonia except in the free state, the 0.66 per cent. of sulphuretted hydrogen remaining in the first group of scrubbers must have assumed the free state and have been held mechanically in solution; that is, about 15 per cent. of the original 3.25 per cent. of ammonia (in the sulphide of ammonium) remained in the free state after all the ammonia had been converted into more than a monocarbonate of ammonia.

These experiments were eminently satisfactory in proving the expulsion of sulphuretted hydrogen by carbonic acid from a solution of pure ammonic sulphide. But in substituting ordinary ammoniacal liquor for sulphide of ammonium we could never thoroughly expel the sulphuretted hydrogen; and although far more than the theoretical quantity of gas was passed, yet the liquor, on analysis, while containing more than the original quantity of

carbonic acid, was largely contaminated with sulphuretted hydrogen in both the free and combined state.

I am exceedingly anxious to know whether the experiments of Mr. Heaton have in any way advanced this matter, or whether the Ammonia and Alkali Company, when adopting the process on a large scale, intend utilizing another source for the production of ammoniacal gas necessary for the success of the scheme.

Annual Report of the Superintendent of Lamps of Boston, Mass.

LAMP DEPARTMENT, Jan. 9, 1882.

To the City Council :—

GENTLEMEN—The annual report of this department for the municipal year 1881 is herewith respectfully presented, in accordance with the ordinance of the city requiring the same to be presented on or before January 10th each year.

It contains a table showing in detail the expenses of the past municipal year; a table showing the comparative expenses for fifteen years; a table showing the cost of the present number of lamps at the rate now paid for gas, oil, and lighting, cleaning, and care of the same.

Tables showing the number of lamps on the 15th day of December, each year, for the past fifteen years, and the comparative increase, together with such general information as may be of interest.

During the past year there has been quite an increase in the number of the public lamps in South Boston, Roxbury, West Roxbury, Dorchester, and Brighton, made necessary by the laying out of new streets and in answer to numerous petitions.

It is to be expected that the call for additional lamps will continue, and likely increase during the next year with the building up of new streets now in progress in the new sections of the city.

Within the past year much progress has been made in the way of discontinuance of the old wooden lamp-posts, and the substitution of iron posts therefor, until now not over 30 remain, which must be replaced during the coming season.

A large amount of work has been accomplished during the past year in the renewal of old and decayed gas pipes, and this is a work which will continually demand attention as the old supplies become corroded and worthless.

GAS.

During the year 1880 the Committee on Lamps succeeded in obtaining what at that time were considered very favorable terms for the supply of gas for the public lamps, and contracts were made, under vote of the Board of Alderman, with each of the several companies, for a term of three years, as follows:

City proper	at $1.50	per 1000 feet.
South Boston	" 2.00	"
East Boston	" 2.00	"
Roxbury	" 1.87½	"
Dochester	" 2.25	"
Brookline	" 2.25	"
Brighton	" 2.25	"
West Brighton	" 2.25	"
Charlestown	" 1.87½	"

Contracts have also been made with the Roxbury Gas Light Company, dated April 15, 1880; and the Jamaica Plain Gas Light Company, dated July 15, 1880 same as the contracts with the other companies, except the insertion of a clause in Section 1, after the words "and between such hours as the Superintendent of Lamps of said city shall direct," as follows: "It being agreed and understood that the hours of burning shall not be less than 3,828 per annum for each lamp, and that the number of lamps shall not be less than the number now in use."

The number of lamps in Roxbury at the date of the contract was 1,659, and in Jamaica Plain 494.

These contracts will expire as follows:

Boston Gas Light Company, April 1, 1883;
South Boston Gas Light Company, Nov. 15, 1883;
East Boston Gas Light Company, Nov. 15, 1883;
Roxbury Gas Light Company, April 15, 1883;
Dorchester Gas Light Company, July 15, 1883;
Brookline Gas Light Company, Brookline and Brighton, June 15, 1883;
Jamaica Plain Gas Light Company, July 15, 1883;
Charlestown Gas Company, April 15, 1883.

A verbal arrangement has also been made during the past year by which the Chelsea Gas Company are to furnish such quantity of gas as may be needed for lighting the Chelsea portion of Meridian street bridge at the same rate per thousand feet as charged by the East Boston Gas Company or a like service.

A comparison of prices of gas established for the past seven years may not be uninteresting, and is as follows:

	1875.	1876.	1877.	1878.	1879.	1880-81.
City Proper	$2.08½	$2.00	$2.00	$1.90	$1.75	$1.50
South Boston	2.50	2.50	2.40	2.25	2.25	2.00
East Boston	2.50	2.50	2.40	2.25	2.25	2.00
Roxbury	2.50	2.45	2.40	2.25	2.25	1.87½
Dorchester	3.00	3.00	2.90	2.75	2.75	2.25
Brookline and Brighton	3.00	2.90	2.90	2.75	2.50	2.25
Jamaica Plain	3.00	2.90	2.90	2.75	2.75	2.25
Charlestown	2.50	2.40	2.40	2.25	2.25	1.87½

Frequent applications are made to learn the price charged for gas by the several gas companies to private consumers, and the information is here furnished:

	Private Consumers.	Public Buildings.
Boston Company	$2.00	$1.90
South Boston Company	2.50	2.50 5 per ct. off.
East Boston Company	2.50	2.50
Roxbury Company	2.50	2.50 5 per ct. off.
Dorchester Company	3.25	3.00
Brookline Co. (in Brighton)	3.00	2.50
Jamaica Plain Company	3.00	3.00 5 per ct. off.
Charlestown Company	2.50	2.50 5 per ct. off.

HOURS OF BURNING.

The public lamps are burning every night throughout the year—a total of 3,828 hours each.

GAS BURNERS.

In 1879 the department adopted an automatic glycerine burner for use in the public lamps, which has continued to give good satisfaction, and to accomplish what is claimed for it by the manufacturers, viz., to measure accurately the quantity of gas, of a certain specific gravity, which will pass per hour.

GAS LANTERNS.

All the lanterns used for the lighting of the streets are made of copper, and all made within the last few years have arrangements for the placing of the names of the streets in them, and an arrangement for placing the numbers securely in the lanterns—an invention of the Superintendent of the department.

This method of placing the street signs and numbers appears to be the best in use, more especially since the adoption of the acid or sand-blast process of producing the signs on colored glass, which makes the letters durable.

The placing of the numbers in the lanterns is being generally extended over the city, and gives great satisfaction to the public, being a great convenience both by day and night.

The advantage of this style of gas lantern for use in this city will be fully appreciated by a knowledge of the fact that nearly one-half of the public lamps stand on the corners of or opposite the ends of streets or places, and have the names and numbers of the streets and places upon them.

EMPLOYEES.

The number of men employed is 138, as follows:—1 superintendent, 1 clerk, 131 lighters, and 5 permanent men in the repair shops.

No deputy superintendents or supernumerary men are employed.

LAMPLIGHTERS' DUTIES, ETC.

The gas lamps are lighted by the use of the torch. The duty of the lamplighters is to light and put out the lamps in their charge promptly at the time designated; to keep the lanterns clean at all times, and report at this office in writing, promptly, for immediate repair, every defect, either of the lanterns or fixtures; to keep the fixtures properly cleaned and oiled, the burners in perfect order, and the pipes clear from water and frost. In case of gas leaks they are required to report immediately, in writing, both at this office and to the office of the gas company; they are also required to make a statement, in writing, on each Monday morning, of all the duty performed during the previous week.

The gas lamplighters, after performing their duty, have a considerable portion of the time remaining, and are allowed to have other employment, provided it shall not in any way interfere with any duty which may be required of them in this department.

The privilege is very generally used by this class of employees, and in this way the city is enabled to procure an intelligent and reliable class of men, at a much less cost than it could expect to do otherwise.

The men who are employed to care for the oil lamps have but little time aside from that which they devote to the work for which they are employed, and in nearly all cases it is necessary that they should employ assistance, and keep a horse and wagon at their own expense.

All men employed to light both gas and oil lamps are supplied with the necessary ladders, hooks, cans, etc., by the city.

The men employed during the year have been generally prompt and faithful, and cases of discharge for neglect of duty have been very rare.

COMPENSATION OF LAMPLIGHTERS.

The men employed for lighting gas lamps in sections of the city where they are employed by the piece, receive 1¾ cents per day for each lamp, and where employed by the day, $1.60 per day; while the oil lighters receive 3½ cents per day for each lamp in charge, as fixed by the Board of Aldermen in 1880.

BROKEN LANTERNS.

The number of lanterns which have been reported by the police as broken the past year was	261
By the lamplighters	6,511
Taken out by repairers without report	815
Total	7,587
Lanterns destroyed	180
Against—	
Broken in 1875	8,268
" 1876	7,444
" 1877	7.527
" 1878	7,587
" 1879	9,757
" 1880	7,929

All repairs of the lanterns are done by the department at its workshop on Albany street. At this shop there are five men permanently employed, and one who works at piece-work on the painting of lanterns.

All the cost of men permanently employed, piece-work, repainting lanterns, painting posts and brackets, carting of lanterns, oil, and posts, stock used in repairing, horse-keeping, etc., are included in the item in the schedule for repairing lanterns.

In addition to the lanterns repaired as above there have been 2,900 lanterns painted two coats, and 3,003 iron posts repainted one coat during the year.

INCREASE OF PUBLIC LAMPS IN 14 YEARS.

Total increase in	1868....	47	Total increase in	1876....	1265
" "	1869....	651	" "	1877....	289
" "	1870....	245	" "	1878....	422
" "	1871....	266	" "	1879....	346
" "	1872....	317	" "	1880....	249
" "	1873....	398	" "	1881....	232
" "	1874....	1764			
" "	1875....	747	Total		7238

The aggregate number of public lamps in the city of Boston is 12,896—an increase of 232 during the past year.

OIL LAMPS.

The petroleum oil (115 fire test) used for lighting the public lamps, where gas is not in use, is purchased of the refiner at the lowest market rate, and has fluctuated in price from 11⅜ to 6½ cents per gallon within the past year.

The fonts from which it is burned are of a peculiar shape, adapted to the city use. The "Fireside" B burner is used. These lamps give good satisfaction where they are in use. The cost of maintenance of these lamps has not exceeded $14.50 each during the past year, including lighting and care, oil, fonts, chimneys, carting, wicking, etc.

PROPERTY OF THE DEPARTMENT.

In addition to the public lamps now located and tools in the hands of the lighters, the department is possessed of the following property:

5 iron posts for stone sidewalks; 16 bridge posts; 3 iron posts for bridges with short bases; 2 iron posts for Federal street bridge; 2 iron posts for Common; 380 iron posts as used on the public streets; 147 new and 453 second-hand lanterns; 170 new lantern frames; a small quantity of old iron, and 190 boxes of glass. Seven horses; 5 wagons; 4 pungs; top buggy, open buggy, sleigh, harnesses, blankets, robes, and the necessary tools for repairing the lamps.

THE THERMO AND ELECTRIC MECHANICAL LIGHTING APPARATUS; OR AUTOMATIC LIGHTING.

On the 7th of November last Alderman Breck, for the committee, submitted the following report and order in the Board of Aldermen:

"The Committee on Lamps, to whom was referred the petition of 'The Thermo and Electric Gas Lighting Company,' that the city adopt its patent process and give a contract for five years for lighting the streets of the city, respectfully report: That they have given the subject careful consideration, and are of opinion that no material saving can be made in the amount o gas consumed by the adoption of the apparatus. The petition estimates the saving in cost of lighting and care of the lamps at an average of 75 cents per lamp per year, or a round sum of $7,500 on the present number of gas lamps should the application be extended over the entire city, against which the city would be subjected to the additional source of annoyance and expense by the removing and relaying of pavement in the public streets. The committee having this subject under consideration have received a proposition from 'The Thermo and Electric Gas Lighting Company' referring to the petition presented, saying:

"'We will light, extinguish, and clean free of any charge to the city of Boston such an area of from two to five miles of lamps as may be mutually agreed upon. The application shall be under the supervision of the Superintendent of Lamps, if you desire it. Should you wish at any time to discontinue our method of lighting, we would have our fixtures removed and your tips replaced within twenty-four hours after we had receipt of such notice.'

"The committee recommend the petitioners have leave to withdraw on their proposition for a contract and the passage of the accompanying order:

"Ordered, That 'The Thermo and Electric Gas Lighting Company' be granted permission to test their apparatus by its application to all the public lamps located in the city proper on the territory north and east of the center of Prince street, from Causeway to Hanover street, and the middle of Hanover street from Prince to Commercial street; the said application to be 'free of any charge' and under the supervision of the Superintendent of Lamps." "For the Committee,

"HUGH O'BRIEN, Chairman."

The order was passed.

The company commenced opening the streets and laying its wire on the 21st of November, but after working a few days suspended operations; and nothing has been done since the 30th of November, notwithstanding the season has been unexceptionable for work of this character, there having been scarce a day during the month of December when work could not have as readily been done as in the summer months.

The pavement has not been properly relaid where it was removed, even after repeated notice to the company. It is understood that the company has voted to postpone any further work until next spring.

ILLUMINATIONS.

While it is acknowledged by people competent to judge that the streets of our city are at least as well lighted as any in the country, there can be no question but that there are locations in this, as in all large cities, where an abundance of light, amounting to an illumination, in the early portion of the night, would be proper and desirable, even at a considerable expense beyond what is now paid for the lighting of the public streets.

The proper disposition of a few large lamps, either gas or electric, on Haymarket, Bowdoin, Scollay, and Park squares, and at some of the corners of Washington and Tremont streets, where large numbers of people leave or enter the horse cars, would be very desirable up to midnight.

During the past year several experiments have been made with large gas lights. The light obtained in some of these experiments has been very much admired, both for its brilliancy and softness to the eye; the lights now in use in front of the City Hall and on Tremont street, opposite West street, giving perfect satisfaction.

The Brush Electric Light Company have, during the past year, been experimenting with the illumination of Scollay Square, and, although there have been occasional entire failures to light, and at others a great variation in the amount of light produced, so much satisfaction has been given that an order was passed in the Board of Aldermen, on Tuesday, the 27th of December last, as follows:

"Ordered, That the Superintendent of Lamps, under the direction of the Committee on Lamps, be authorized to contract with the Brush Electric Light Company for lighting certain streets and squares for one year, at the rate of 65 cents per light each night, the number of lights not to exceed one hundred, and to be located upon such streets and squares as the committee may select."

The expense of maintaining one of these large lights is eight times that of the ordinary street lights in use in the city proper; but the comparative increase of cost of this method of lighting must be determined by the number of ordinary gas street lamps that can be replaced.

It seems to be the opinion of those who are interested in the subject that to do effective work these lights should be located about 150 feet apart; the average distance of the present gas lights being about 125 feet from each other.

There can be no question of the brilliancy of the light obtained when in working order; but the amount of money which our citizens will be called upon to pay enters largely into the question of the general lighting of our streets in the manner proposed.

THE COMMON AND PUBLIC GROUNDS.

The lighting of the Common and public grounds has heretofore been under the charge of this department. A few years since the attention of the government was called to this subject, in the annual report of the department, with the suggestion that the cost of lighting the Common and squares should properly be charged to the appropriation of that department.

The suggestion is again renewed, and should receive serious consideration, in view of the possibilities of a very large increase in expenditures in that direction during the ensuing year, as suggested by the Superintendent of Common and Squares and the Police Commission.

It is probable, also, that as the work of establishing the new system of parkways and public parks makes progress, this feature of them will enter largely into the annual cost of lighting our city, and it may be well to determine if such expense should not be charged to that department, as is done in other large cities.

The committee on the department have devoted considerable time to the examination of locations in which additional lamps have been asked for; they have looked with care after the expenditures of the department, and had a general supervision of the purchase of material, which has been procured with the advantages of the largest discounts.

The committee consisted of Aldermen O'Brien, Breck, and Tucker.

There are at the present time over 400 miles of streets and places lighted by this department, covering a more extended territory than any other similar department in the country.

The length of streets lighted in the old city limits in 1867 did not exceed 85 miles.

FINANCIAL CONDITION OF THE DEPARTMENT.

The balance of the appropriation on hand from 1880 on the 1st of January, 1881, was	$135,620 53
There was expended during the remainder of the financial year	120,785 87
Balance unexpended and transferred to other appropriations was	$14,834 66
The appropriation for the financial year ending on the 30th of April next was	$431,500 00
Amount expended to date	293,681 92
Balance unexpended	137,818 08

—an amount sufficient to meet all anticipated expenditures of the department for the remainder of the financial year.

The great aggregate cost of supporting this department is to be traced directly to annexation, as one-half of all the street lamps are located within the annexed territory, and more than one-half the appropriation is expended outside the old city limits.

COST OF GAS, LIGHTING, AND CARE OF PRESENT NUMBER OF GAS LAMPS, AT PRESENT RATES.

Name of Gas Light Company.	Number of Lamps, Dec. 15, 1880	Rate per thousand cubic feet.	Yearly charge for gas for each lamp.	Cost of Lighting and Care of each lamp per annum.	Cost of Gas, Light'g and Care for each lamp per annum.	Total cost of Gas, Lighting, and Care for this number of lamps per annum.
Boston	4,273	$1 50	$22 96	$5 93½	$28 89	$123,486 49
East Boston	619	2 00	30 62	5 93½	36 55	22,627 69
South Boston	918	2 00	30 62	5 93½	36 55	33,537 71
Roxbury	1,770	1 87	28 71	6 59+	35 30	62,481 00
Dorchester	1,029	2 25	34 45	7 36+	41 81	43,024 54
Jamaica Plain	517	2 25	34 45	6 77+	41 22	21,311 77
Charlestown	841	1 87	28 71	5 93½	34 64	29,133 29
Brighton	395	2 25	34 45	7 39+	44 84	16,527 59
Brookline	62	2 25	34 45	9 41+	43 86	2,719 44
Chelsea	3	2 00	30 62	5 93½	36 55	169 66
Totals	10,427	$1 81+	$27 71+	$6 30+	$34 01	$354,979 18

Each lamp burns 3,828 hours, consuming 4 feet of gas per hour—making annual consumption of each lamp 15,312 cubic feet.

COST OF OIL, LIGHTING, AND CARE OF PRESENT NUMBER OF OIL LAMPS, AT PRESENT RATES.

Location of Lamps.	Number of lamps burning.	Total Consumption of Oil for this number of lamps per annum.	Total cost of Lighting and Care per annum.	Total cost of Oil, and Lighting and Care for year.
		Gallons.		
City Proper	94	3,008	$1,071 60	$1,259 60
East Boston	271	8,672	3,089 40	3,631 40
South Boston	522	16,704	5,950 80	6,994 80
Roxbury	34	1,088	387 60	455 60
Dorchester	597	19,104	6,805 80	7,999 80
West Roxbury	693	22,176	7,900 20	9,286 20
Brighton	258	8,256	2,941 20	3,457 20
Totals	2469	79,008	$28,146 60	$33,084 60

Each lamp consumes 32 gallons of oil per annum, costing 6¼ cents per gallon, or $2 for each lamp. The cost of lighting and care was $11.40 per lamp per annum. The number of hours each lamp burned was 3,828. The oil was 115° fire test

Respectfully submitted,

GEORGE H. ALLEN,

Superintendent of Lamps.

[From the London "Journal of Gas Lighting."]

The Proposed Reduction in the Quality of Glasgow Gas.

Our readers are aware that the Glasgow Corporation Gas Commissioners are intending to proceed with a Bill in the next session of Parliament to enable them to reduce the standard quality of the gas supplied in the city from 25 to 20 candles. The following "Memorandum," by Messrs. Wallace and Foulis, has been submitted to the Town Council—

The standard illuminating power of gas, as fixed by Act of Parliament, does not arbitrarily decide the quality of gas to be manufactured, but merely the limit below which it cannot be reduced, without rendering the manufacturer liable for the penalties stated in the Act.

In order that the quality shall not fall below the fixed limit, it is necessary that the gas should be manufactured of a higher quality than the standard. While the minimum is fixed at 25 candles, it is necessary to manufacture gas at 26½ to 27 candles, as gas of this quality deteriorates considerably when kept in the gasholders even for a few hours, especially in cold weather.

When gas is said to be of a certain quality, it does not follow that a light equal to that quality will be got from it under whatever conditions it is consumed. In order to get this amount of light it is necessary that the gas should be consumed in a properly constructed burner, under a suitable pressure, and at the rate of 5 cubic feet per hour. If, however, the gas is burned in smaller quantity or under greater pressure, the results are widely different, and it has been shown that the same gas may be burned in equally good burners, but under different conditions as to pressure and consumption found in actual practice, so as to yield a light varying in intensity from that given by a gas of 9 candle power to that of a gas of 32 candle power. It may be said generally that the larger the flame and the lower the pressure, the greater will be the amount of light developed from the gas.

One or two examples may be given as to the effect of what has been stated above on the illuminating power of the gas as actually consumed in Glasgow. The sizes of burners mostly used in Glasgow are those consuming from 2½ to 4 feet per hour under a pressure of 1 inch. If the gas is of a quality equal to 26 candles—that is, that it will yield a light equal to 26 candles when consumed in a test burner under a pressure of 5-10ths of an inch and at the rate of five feet per hour—the gas, when consumed at the rate of 2½ feet per hour under a pressure of 1 inch, will only yield a light equal to 6½ candles, equivalent to 13½ for five feet. So that, under such conditions, only half the amount of light is developed from the gas; and, when consumed at the rate of four feet per hour under the same pressure, the light given will be only 15½, or at the rate of about 19 candles for five cubic feet. In each case the burners are assumed to be in good condition.

It results, then, that while gas of 26 or 27 candles is being made at a high cost, the consumers are not developing more than an average of 16 or 17

candles from it. In order to develop the greatest amount of light from the gas, it is necessary that it should be burned under a low pressure; but the higher the quality of the gas the more difficult it is to burn it at a low pressure, on account of the tendency of the flame to become yellow and smoky.

In the street lamps in Glasgow, gas is consumed at the rate of 2 cubic feet per hour under a pressure of 5-10ths of an inch, and yields a light of 7 candles, or at the rate of 17½ candles for 5 cubic feet.

In London, and generally throughout England, the gas in the street lamps is consumed at the rate of 5 cubic feet per hour, and at a low pressure; and, as the quality of the gas is about 16 candles, a light equal to nearly 16 candles is got from it. While in Glasgow, therefore, 26 candle gas is manufactured and sold at 3s. 8d. per 1,000 cubic feet, in the South 16-candle gas is manufactured and sold at 2s. 6d., and from an equal quantity of the cheaper gas an amount of light is obtained in the street lamps nearly equal to that obtained from the gas of higher quality.

It is not intended to be argued from the foregoing remarks that the quality of the gas should be reduced to 16 or 17 candles, but rather to point out that in considering this subject there are other questions than that of mere photometric value, which must be taken into account; and inasmuch as the full illuminating power is seldom, if ever, obtained from the gas in actual practice, it becomes a question of considerable importance to ascertain how far the increase of illuminating power is worth the money it costs to obtain it.

There would be little difficulty in deciding this question if the only consideration was—From what quality of gas may be obtained the maximum amount of light, altogether independent of cost? Gas is, however, not now a luxury. It enters largely into the question of cost of production in many manufactures, and the question which the Corporation have to consider is not that stated above, but rather—From what quality of gas may be produced the greatest amount of light for the least amount of money?

The quality of gas which is most economically manufactured in any particular district depends, in a great measure, on the quality and price of coal most easily obtained in the locality. For example, the coal suitable for gas manufacture most readily obtained in the towns situated in the eastern and southern portions of England is the bituminous coal from the coal fields in the vicinity of Newcastle. This coal yields a very fine coke and a large quantity of gas of 16-candle power. Gas of 16 candle power is therefore the standard in the towns in the districts above-mentioned. Liverpool and Manchester, and the towns in the north-western portions of England, are in convenient proximity to the cannel coal of the Wigan coal fields, which yields a gas of 20 to 22 candles, with a good coke; and 20 candles is therefore the standard in that district. Glasgow is situated in the immediate vicinity of coal fields containing cannel which yields a gas varying from 22 to 25 candles, and there are also in the neighborhood fields of splint coal, which can be had at a small cost, from which gas of from 17 to 20 candles can be readily obtained. None of these last are, however, available at present, in consequence of the high minimum standard.

In order to get a gas of 26 candles, it is necessary to use a certain proportion of cannels which come from a greater distance, and which yield a gas from 28 to over 30 candle power, and the question to be considered is the purely commercial one, whether the additional quality thereby obtained is worth the cost.

In considering this subject, it should be noted—

First—that gas of 28 to over 30 candles is much less permanent in its character than gas of lower quality; that is to say, it is much more easily affected by changes of temperature, and frequently during cold weather, while 27 or 28 candle gas is being made at the works, the quality has fallen to little over 25 candles when it reaches the consumer.

Secondly—while there can be no doubt that the higher quality of gas will give more light if burned under proper conditions, yet, inasmuch as it is necessary, in order to develop the full amount of light from the gas, that it should be burned at a low pressure, and because gas of high quality when burned at a low pressure produces a yellow, smoky flame, it is more difficult in practice to develop the full amount of light from it.

Lastly—there is the cost of the coal necessary to produce this increased quality. Without going too minutely into the cost of coal, which is a matter to be dealt with by the gas committee, it may be stated that the rational way to calculate the value of a coal is to ascertain how much light can be got out of it for a given amount of money; and, tested in this way, it is found that the higher class coals have a selling price much out of proportion to their intrinsic value.

Gas is now being used for many purposes of trade and domestic use besides that of giving light. A cheap gas would therefore tend to develop and encourage many industries, and would greatly increase the rate at which gas is being introduced for such purposes, and would consequently render the property of the Corporation much more secure against any depreciation which might possibly arise should electricity become a competitor for the purposes of general illumination.

As already stated, if the minimum were fixed at 20 candles it would not prevent the gas being made of any quality that might be thought desirable; but the above considerations certainly suggest that the Corporation ought to have a greater amount of freedom in the business of gas manufacture than they can possibly have with a 25-candle minimum.

Although it may not affect the intrinsic merits of the question, yet it may be of use to compare the position of Glasgow in this matter with the principal towns in the Kingdom. There is accordingly appended a list of some of the principal towns in England and Scotland with the parliamentary standard of quality of gas in each. It will likewise be observed from the excerpts from the Acts of Parliament also appended, that the parliamentary standard of the Glasgow City and Suburban Gas Company and the Glasgow Gas Light Company who formerly supplied Glasgow, was 10 and 12 candles respectively, while that at present supplied by the Corporation is fixed at 25 candles. [Signed] W. Wallace,
Glasgow, Jan. 16, 1882. W. Foulis.

1.—LIST REFERRED TO.

	Quality in Candles as Fixed by the Act.
Birmingham Corporation	12
Bristol Company	13½
Liverpool Company	20
London Companies	16
Newcastle-on-Tyne Company	14
Nottingham Corporation	12
Aberdeen Corporation	20
Dundee Corporation	18
Edinburgh Company	No. limit.
Edinburgh and Leith Company	"
Greenock Corporation (applying this year to reduce to 20)	25
Inverness Corporation	20
Paisley Corporation	25
Perth Corporation	25

2.—EXCERPTS REFERRED TO.

(1) The Glasgow City and Suburban Gas Company Act, 1857, section 40 provides—"All the gas supplied by the Company shall be of such quality as to produce from an Argand burner having 15 holes and a 7-inch chimney and consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by *ten* sperm candles, of six in the pound, burning one hundred and twenty grains per hour."

(2) The Glasgow Gaslight Company's Act, 1857, section 14, provides—"All the gas supplied by the Company shall be of such quality as to produce from an Argand burner having 15 holes and a 7 inch chimney, and consuming 5 cubic feet of gas per hour, a light equal in intensity to the light produced by *twelve* sperm candles, of six in the pound, burning one hundred and twenty grains per hour."

(3) The Glasgow Corporation Gas Act, 1869, section 55, provides—"All the gas supplied by the Corporation shall be, at least, of such quality as to produce from a union jet burner capable of consuming 5 cubic feet of gas per hour, under a pressure equal to a column of water 5-10ths of an inch in height, a light equal in intensity to the light produced by *twenty-five* sperm candles, of six in the pound, burning 120 grains per hour."

Recent Improvements in the Scotch Mineral Oil Industry.

This industry, which is now one of the most important in the country, was founded only thirty years ago. Since its origin, it has had to pass through more than one severe struggle for its existence; and it has brought into play, in a marked degree, the characteristic dogged determination with which our countrymen fight for their position against long odds. When, in 1850, Mr. James Young took out his now famous patent for "treating bituminous coals in such manner as to obtain therefrom an oil containing paraffine," that substance was known only as a laboratory specimen, which, twenty years earlier, had been introduced to the chemical world by Baron Reichenbach.

At the present time its production exceeds 25,000 tons per annum. It is obtained chiefly in Scotland, Germany and America; but is also produced in Galicia, Australia, etc.

During the existence of Mr. Young's patent—*i.e.*, from 1850 to 1864—the history of the industry is little more than a record of the rise and progress of the Bathgate works of Messrs. Young & Meldrum; but from the latter year up to 1871, the manufacture was rapidly extended, and by 1872 the production of crude paraffine oil had reached the large figure of 25,000,000 gallons per annum. The new industry had no home rival to fear; but the opening up of the American petroleum wells, which began in 1860, was an event which brought on the field an opponent destined to task to the utmost the ability and energy of the paraffine oil manufacturers. The first ship

ments of petroleum were made to this country in 1862, and by 1870 the deliveries to the United Kingdom had risen to about four million gallons per annum. While the price of petroleum was comparatively high and cheap labor lasted, and shale and coal could therefore be obtained at moderate prices, the Scotch makers were able to hold their own with ease; but when petroleum fell and wages rose considerably, they had to prepare for a stiff fight. About 1870 began those efforts to improve and cheapen the distillation of shale which have had a most important influence on the position of the industry during the past few years.

Hitherto coal had been required for heating the retorts; but Mr. William Young, of the Clippens Oil Works, succeeded in showing that the shale residue remaining after the oil had been distilled off contained sufficient carbon to do most of the heating work, and that, if it were used while still red hot, it could be satisfactorily employed for this purpose. An improvement on Mr. Young's method of utilizing the residue was shortly after introduced by Mr. Norman Henderson, and for some years the "Henderson Retort" has been the form most approved by oil makers.

Thanks to the efforts of these and other gentlemen, petroleum seemed, for the time being at least, robbed of its power to destroy the native industry, and a period of good dividends seemed likely to be vouchsafed to oil shareholders. And if at this time the American wells had considerately agreed to withhold a portion of their supplies, a golden era would have begun for the home trade. But the wells, so far from fulfilling the prophecies of those in this country who were interested in shale oil, continued to yield greater and still greater quantities; and during the past year the shipments from the United States to all parts of the world amounted to 447 million gallons as compared with 322 million gallons in 1880. To make matters worse for the Scotch makers, paraffine "scales"—*i.e.*, crude paraffine—which had hitherto helped more than other product to keep the wolf from their door, sustained a heavy fall.

While the prospects of the trade were thus again being overcast, experiments were in progress which have proved that the possibilities of shale had not been exhausted when the discovery was made that it could furnish the fuel for its own distillation. It now appears that, while attention had been concentrated on the carbon present in the shale residue, the still more valuable element, nitrogen, had been too much neglected. The shale operated on in the Scotch oil works yields, for the most part, from 11 to 16 lb. per ton of sulphate of ammonia—a valuable salt in high repute as an artificial manure. But the shale residue, when transferred from the retort to the furnace, has not been made to give up all its nitrogen; on the contrary, it has now been found that a ton of shale, instead of yielding 16 lbs., ought to give not less than 40 lbs. of sulphate of ammonia. That the shale residue was not exhausted of its nitrogen when it left the retorts has been known to chemists for some years; but it has been left to Mr. Beilby of the Oakbank works, and Mr. William Young, of the Clippens works, to show how the increased yield of ammonia may be secured. Working independently, each inventor has succeeded in devising a retort by means of which the increased yield of ammonia can be obtained without injury to the quantity or quality of the oil.

The main features of the new retorts may be briefly described thus—

To the bottom of an ordinary vertical cast iron retort, as used for obtaining oil from shale, a vertical fireclay retort is connected. The shale is introduced at the top of the upper retort, and, while passing downwards through it, parts with the oil; when it reaches the fireclay retort, it is subjected to a higher temperature, and gives off the ammonia hitherto lost. The bottom or fireclay retort is heated by means of a coal furnace to a bright red heat, and the furnace gases leaving this retort pass to a chamber in which are pipes for superheating the steam which is introduced near the bottom of the lower retort. No flame is allowed to play on the upper retort, which is heated externally only by the heat radiating from the tiles which cover the oven in which the fireclay retort stands. Little external heat is needed, however, in the case of the oil retort; for the steam entering the lower retort is so highly heated in its passage upwards so as to be able to effect the distillation of the shale without much assistance.

It will be seen from this description that the invention is based upon the recognition of the fact that, for the ends in view—viz., the obtaining of the maximum quantity of paraffine oil of the best quality along with the greatest yield of ammonia—widely different temperatures are required.

To apply the higher temperature required for securing the full yield of ammonia to shale from which the oil has not been first distilled, is ruinous to the latter; while, to allow the shale residue to escape after having been subjected only to the lower temperature is to sacrifice more than a half of the ammonia in the shale.

It is difficult not to look upon this invention as perhaps the most important improvement that has yet been introduced since the industry began, and we trust that Messrs. Beilby and Young (who, we understand, have wisely resolved to combine their forces) may be able to work out their improvements to the fullest advantage.—*The Scotsman.*

Collapse of a Gasholder in Newark, N. J.

The Newark *Daily Journal*, of Wednesday, February 1st, gives the following account of the collapse of the gasholder belonging to the Citizens Gas Light Company, which occurred on the evening of January 31st, ult.

About seven o'clock last evening it became evident to those in charge of the works of the Citizens Gas Light Company on Front street, that the iron frame which held the gasholder was giving way. Two of the columns were cracked and the fierce gale which was blowing caused the iron frame to bend and twist, so that at every moment the structure was expected to go down. Mr. Andrew A. Smalley, the President of the company, was sent for, and he immediately stationed men at each end of the street to warn those who might intend to pass of the danger. Several families residing in the neighborhood left their houses and some prepared to remove their furniture. The gasometer was 97 feet in diameter with a capacity of about 300,000 feet, and was about one-third filled. The gas was being drawn off and transferred to another holder, when, a few minutes before nine o'clock, the structure went down, and as it fell, with a hissing sound, a column of flame more than 50 feet high shot in the air. People were momentarily blinded with the sight. Women became frantic, and even some men thought for a moment that the day of judgment had come. The flame was visible only for a minute, and then the whole portion of the city north of the canal was left in total darkness. The fire department turned out, but there was no occasion for their services. No person was injured, and, with the exception of the blistering of the paint on the cupola of Ballantine & Sons brewery, no building received any serious damage.

Mr. Smalley stood in a doorway within 30 feet of the gasometer when it fell, and he remained there. He says he had no fear. He believes the flame was caused by the gas being ignited from sparks struck from the iron frame when in falling it crashed against the sides of the tank. The gasometer was torn and rent like a great balloon cut in pieces. There was no explosion; it was simply a collapse. About 20 feet of the wall along Front street is broken down, and ten feet of the coping thrown from the side wall. Beyond the destruction of the gasometer and frame this is all the loss the gas company has sustained, except the loss of gas and custom. The damage is estimated at $20,000. The tank is uninjured.

The gasometer was erected about 13 years ago. The columns, which were of cast iron, show numerous old cracks and flaws in the iron, indicating that the contractor had done his work very imperfectly. There were no braces or stays at the base, and, considering the bad material and the careless construction, it now seems strange that the structure stood as long as it did. Gasometers are strengthened at the base of the columns with extra braces of wrought iron.

Connection with the mains of the Newark Gas Light Company has already been made, and Mr. Smalley promises that to-night no part of the city shall suffer from want of gas. Fortunately the new gasometer in Orange is ready for use, though it has not yet been used.

About sixty days will be required in which to re-build the gasometer. The columns are always kept ready by the contractors, and they will be put up immediately. The main delay will be in building the holder.

Harrison was brightly illuminated by the burning gas. At the time a number of firemen were in the engine house, and they hastily made a start to roll the apparatus before they discovered their error.

The flame from the gas was witnessed by many residents of Roseville, Orange, Montclair, and many other elevated suburban places. It burst upon the stormy sky in a broad red glare, and seemed like an enormous cloud sweeping with lightning rapidity at the houses. Many women were frightened, as even at two miles distance the flame seemed to dart at the windows, and during a moment rooms in which no lights were burning were brilliantly illuminated. The time during which the flames were seen could not have exceeded one minute. They disappeared as suddenly as they came. To the citizens living at remote distances from the scene, and who had no means of learning the cause of the strange spectacle, the ringing of fire bells amid the swirling of the snow and the howling of the storm were painfully suggestive of a horror similar to that which occurred in New York yesterday.

A Failure of Electric Lighting.

A late issue of the Lowell (Mass.) *Mail* contains the following:

Sometime since the Merrimac Woolen Mills placed sixteen 2,000-candle power electric lamps in its weave room, but after a thorough trial they have been removed for several reasons. It was found that they were twice as expensive as the gas manufactured and used on the premises, and though there was a sufficient volume of light it could not be concentrated upon the looms in a satisfactory manner. The frequent flashing of the lights, and the necessity of extinguishing all when any one was out of order was unsatisfactory, and moreover there was a possibility of the insurance companies

increasing their rates. The inflammable character of the dust arising from the work renders lights of such intense heating capacity somewhat dangerous, and will do much to prevent their introduction in such places as the interior of a cotton or woolen manufactory. This action does not seem to be final, however, as it is added that a trial of the Edison lamp may be made some time in the future.

Report of the Gas Committee of the Manchester City Council.

At the monthly meeting of the Manchester City Council held Jan. 4th, the Mayor (Mr. Alderman Baker) in the chair. On the adoption of the report of the gas committee being moved, Alderman King inquired how soon gas was likely to be produced at the new gas works now being constructed at Bradford. Had the recent fogs continued a few more days they might have been placed in great difficulty. On Thursday the consumption of gas was 14 millions feet, and on Friday they were only able to supply 12 millions feet. Had Saturday been equally foggy they would have been in a great difficulty.

Alderman Harwood said the scarcity of gas arose through the negligence of Alderman King and his colleegues when in office, not making the necessary provision of purifiers. He condemned the extravagant expenditure on the land at Bradford, which had cost them three times as much as it would fetch in the market that day. Alderman King should take the responsibility of his own blundering. The present committee had succeeded people who were not wise in their generation, and who without the knowledge of the council bought land in an unsuitable place. Experienced men said the new works were in the wrong place, but inexperienced men held they were in the right place. Ald. King was sure to keep them right, as he was carefully watching them. So far he could say they had never been short of gas.

Mr. Southern said it was incorrect to state that the people of Manchester had not been short of gas. He would ask Alderman Harwood to state how many complaints were made to the committee on the 24th of December. Ald. King had raised a question of vital and immediate importance. It was all very well to make capital out of the blunders of the past—as to the works being in the wrong position and the amount expended upon them, but it was impossible for them to do other than to make the best use of their works as they were and where they were. They could not get the money back and they could not shift the works. As a member of the gas committee he thought their conduct with regard to providing gas for the people was simply discreditable. Had they done their duty they ought to have been able to light all the streets on the recent foggy days, but with their present supply they dare not light them. He considered they had no right to reflect upon Ald. King for bringing the matter before them in the temperate manner he had done.

Ald. Thompson said the public were not so well satisfied with the gas committee as the gas committee were with themselves. He might mention the case of two gentlemen who held 400,000 spindles, and who consequently were large consumers of gas. These gentlemen complained bitterly both as to quality and quantity of the gas supplied. So long as the corporation held this monopoly they ought to produce a good as well as a cheap article and this they did not do at present. The strength of their productive power was what they could give to the public after not one foggy day but a succession of foggy days. They ought to be prepared for a week of foggy days; they ought to have a sufficient reserve for lighting the premises of the ratepayers after a succession of foggy days such as were experienced last year and the year before. He thought with Mr. Southern that it was a very discreditable thing for the Manchester Corporation that in most of the darkness a fortnight ago there was not a single gas lamp lighted in the streets. He trusted such a state of things would be remedied.

Mr. Howarth said Ald. Harwood was slightly in error in saying that no complaints had been made from time to time about the gas, because complaints had been numberless.

Mr. Hilton said, with regard to the shortness of the supply, he was assured by a gentleman in the council that Mr. West, the engineer, told him that a fortnight ago they were within 15 minutes of the gas going out altogether, so that they were approaching very near that point when it was absolutely necessary to do something to relieve the committee from a very awkward position like that.

Ald. Lamb, in reply, said that when the foggy days came they had only 8½ millions of cubic feet of gas in stock, but they now had 11 millions cubic feet in hand. It was very true that they had a number of complaints on the morning of the fog, and if the committee could have given all the necessary pressure there would have been plenty of gas all over the city, but unfortunately they were not in a position to do that. In 1875 the demand was greater than the supply, and they had to burn farthing candles at the old Town Hall with the gas. Ald. King then got the sanction of the council for the purchase of the plot of land in Bradford. He (Ald. Lamb) said at the time that was the best plot they could possibly have, and if the holders had been placed where Ald. King and he desired they should be, viz., at the bottom, they would have been the best that they could have. Well, the works were made, but why had they not made gas there yet? Ask Ald. Bennett. He asked the gas committee to be very careful what they were doing because of the electric light, and not to spend a single penny until they were forced to do so. That was the reason they had not yet made gas there; they had not needed it, but everything was prepared and ready, and they would be able to make gas there at the expenditure of a penny more than had been already spent.

The minutes of the committee were confirmed.—*Review of Gas and Water Engineering.*

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Funeral of Mr. George Dwight.

SPRINGFIELD, MASS., Feb. 3d, 1882.

To the Editor AMERICAN GAS LIGHT JOURNAL:

Yesterday will be long remembered in this city as a sad day. It is seldom that any place makes a demonstration so spontaneous and so heartfelt as might have been witnessed here upon the occasion of the funeral of Mr. Dwight.

Identified with the best interests of the place from his early manhood, no man in our midst commanded more universal respect than he who was followed yesterday to his last resting-place by so large a concourse of his fellow citizens, and friends from far and near. The profession of gas engineers was represented by about forty gentlemen, coming from all parts of New England, and also from New York, Philadelphia and Pittsburgh.

The pall-bearers, from the New England Association of Gas Engineers, were W. A. Stedman, S. G. Stiness, George D. Cabot, J. H. Armington, F. C. Sherman and Geo. B. Neal. The services at the church were very plain and simple, and attended by a large concourse of people. Every available portion of the edifice was filled, and it was a peculiarity of the occasion that all classes of people were represented, from the humblest walks of life, as well as from the higher circles. Mourners who felt that they had met with a personal loss might be seen uniting most heartily in rendering whatever expression they could of their sorrow at losing so true a man, so kind a friend, and so sound a counsellor.

The floral decorations were profuse; but one that was more touching, perhaps, than some others was from the workmen of the gas works. From their earnings they contributed most generously, and sent a floral offering which represented a gasholder, and it was a most beautiful and elaborate composition. After the services in the church the long procession took up its line of march to the cemetery. Thirty men from the gas works, and a detachment of fifty men from the fire department, acted as a bodyguard, following the body as far as the cemetery gates. Then followed the carriages conveying many friends; and as the long line wound along the snowy paths of the beautiful cemetery everything seemed hushed, as if in respect and reverence for the last solemn act that friendly hands were about to perform. The grave was lined with evergreens, through which flowers and smilax were entwined, and as the remains reached their final resting-place the hands of fond friends strewed flowers upon the casket until it was hidden from view. "Dust to dust, ashes to ashes;" the blessing; the subdued "Amen;" the stifled sobs of the afflicted family—and all was over. Thankful that such a man had lived; proud of an association with him; sad that such a one was no more—the party separated. The mortal body of our friend we left there in the grey of the evening; but his example and his influence still live, and will ever be felt by all who knew him. DELTA.

An English Engineer's Criticism of Certain Statements by Electricians.

LONDON, January 12, 1882.

To the Editor AMERICAN GAS LIGHT JOURNAL:

As a reader of your JOURNAL on this side of the Atlantic will you allow me to make a few observations on some of the recent articles which appeared in your last two numbers, Dec. 2d and 16th. I will refer first to an address by Leo Daft, given before the New York Electric Light Association, page 274, in JOURNAL of December 16th.

The article does not say what the object of the address was. It may be to enlighten the citizens of New York as to the mysteries of the electric light, which can scarcely be necessary, seeing you have it in all sizes and shapes and systems. I am, therefore, left to conjecture, and can only suppose it was for some ulterior motive; but it is only owing to the usual misleading statements it contains that I am induced to notice it—such mis-statements should not be allowed to pass unchallenged. At the same time I cannot help but think there are many able men in New York who can, and who ought to, expose such fallacies as soon as they are made, and prevent them

from spreading, and so try to prevent the bolstering up any longer of a fast-failing bubble.

I will pass over all the usual clap-trap about the pound of coal maintaining a light equal to 13,000 candles for one hour, and the comparison of the light given to be identical with the light of the sun—which we know is not true—nor the heat being equal to 59,000°F., as he confesses further on that "these rays contain very much less of the heating principle than those from gas, or other artificial light." What I wish to point out are his inaccuracies in making the comparison with gas. He says, "I want to be as fair as I can in the matter. I wish to compare this, as they have taken particular pains to compare it, with gas at the present price of gas." And then he goes on, and notice how *fair* he is, "The 100 lbs. of coal will produce 400 feet of gas, 400 feet of gas will evolve the effect of 1,500 candles; so you see the position we are in. In consuming that coal by destructive distillation you can produce 1,500 candles light; by converting it into power, and then again into light by incandescence, you produce 992! Expressing this in other words we may say that, in producing the light from coal by the incandescent system, you lose one third of the power, as compared with gas, by actually converting the coal into gas and delivering it in the ordinary manner. *Those are facts.*"

Now he knows very well that one pound of coal produces five cubic feet of gas, and 100 lbs. would produce 500 cubic feet; and instead of 3.5 candles, per cubic foot, of light evolved, by the new burners there is 6 and 7 candles obtained and, by the Siemens burner, 8 candles, and, by the new Douglass burner, more, (I had an opportunity of witnessing, at the Trinity House here a few days ago, the Douglass burner giving 9 candles per cubic foot), but I will not take the full limit, but say 8 candles per cubic foot, as in the Siemens burner, now, and for the last two months, on exhibition, at the South Kensington smoke abatement exhibition, and the gas engine he describes will require 120 lbs. of coals, instead of 100 lbs. which he has placed it at. The gas given off by 120 lbs. of coal will be 600 cubic feet, instead of 400, and will give a light equal to 4,800 candles, instead of Mr. Daft's 1,500 candles, or, by the French measurement which he adopts with regard to his electric lights, the gas will be equal to 19,200 candles, as compared with the incandescent system he mentions of 992 candles.

Then he goes on to show the superiority of some arc system he advocates and compares with the incandescent form, which is all vague and ambiguous, and closes his address by saying, "I hesitate somewhat to make these allusions, since so many wild promises remain unfulfilled," etc., etc., "thus removing the greatest barriers of the past, and paving the way for that philosophical millenium inevitably awaiting those who may be fortunate enough to survive the *next decade*." What stupid nonsense! In 1878 you Americans startled us by giving out that gas would be entirely quenched in three or four year's time by the light of the future; it is still the light of the future, for now we have to wait 10 years for it according to Mr. Daft. All this is very tiresome, we are getting quite weary of it over here, and it is quite time the huge inflated bubble was sat upon and burst, the sooner the better; it is fast collapsing on this side of the water.

A fortnight ago there was published a very pathetic letter in the *Gas Review*, from one of the principal electric light companies appealing in unmistakable tones of suffering and disappointment to the gas companies of London to come to their help. I suppose the money is nearly all spent, and, no returns coming in, syndicates and speculators are no doubt getting tired of it. But it is impossible for the directors of gas companies to come to their help—they are all honorable men, of high commercial integrity and business knowledge, and could not be associated with such schemes; they are trustees of widows' and orphans' money, and have to return a dividend upon the money entrusted to their keeping and not to waste it in keeping before the public a dazzling toy to please it. The Savoy Theater has been tried—and here is an extract from this week's *Engineering*, of the 6th, (which has become the electrician's organ, to the exclusion of all other kinds of engineering, and is scarcely worth subscribing to now, as it is of no use to the ordinary engineer), it says:

"There are 1,200 incandescent lamps in the theater, including stage and auditorium, every part of it is now lighted solely by electricity, * * if we except one or two gas jets, kept burning in safe places, to provide against any interruption of the electric current and the lime lights. * * * The acoustic properties of the stage are *doubtless* improved by the suppression of gas (a matter which is especially important in opera), and the stream of heated gas arising from the burning footlights can no longer act as an acoustic screen to distort the music of the singers.

"It is a question, however, if a smaller number of large incandescent lights of the Maxim type would not be better behind the scenes than the hundreds of small 15-candle lamps of Swan's, many of which did not yield more than 8 to 10 candles, *and some even less*. The 15 candle incandescent lamp is too small for the illumination of large spaces, such as a stage; but, on the other hand, the arc light is *too unsteady*," etc.

I think comment on the above is needless; but it is rather showing how matters are turning—dissatisfaction everywhere, and misrepresentation made to keep it afloat before the public. *Engineering* does not say there are three very large gas meters constantly going, and four large lime-lights to help on the stage, nor how often the lamps are changed; but all these things are known—and as to the gas footlights causing an acoustic screen, it is just the reverse, for, by causing a rarefaction of the atmosphere, the sound waves are assisted on their way to the audience; but nothing is too bad to say of the gas—"try and give a dog a bad name," etc.

Enough of electricity. I have just a word or two to say about the lecture by Mr. Page, as reported in yours of Dec. 2d, p. 245, on residual products, which is all very good, and is an excellent *resume* of the coal tar color trade; but its goodness is quite spoiled by the introduction of so much bombast. For instance, at page 247, he says, "Dr. Letheby said, 'gas would be the residual product.' Had his life been spared * * he would have witnessed the fulfillment of his prophecy. That time will come in the near future, and for the United States; *because* inventive talent here is riper and more active than on the other side;" and a little further on, on the same page, he says, "When Germany wants the article from which to produce indigo she will send to you for it. Other countries will then send to this country for the supply of anthracine;" and, on the next page, he goes on to say, "So new in this country is the chemical development of coal tar products that we are still in the A.B.C.;" and then, with glorious inconsistency, winds up by saying, "While other bright young men are obtaining a practical knowledge of the subject by going *across the water* and finding employment in the aniline and alizarine works on the other side, working as day laborers, in order that they may *bring back to America the information* as to the practical details of the art which they will thus acquire." Now, after that sentence, what becomes of the "ripe and active inventive talent."

We are getting somewhat accustomed to tall talk; and we know you are a great people, and that your light could not be hid; no, not even under a a buffalo-hide steel-plated bushel! But why give expression to such nonsense at a gas managers meeting? It is not safe to prophesy until you know; and Mr. Page should have waited till these "bright young men" get across again

I have the pleasure of knowing a good number of American gas engineers who have been on this side the water the last 15 years, but I do not remember the name of Page, or I should say to him, when he next addresses the Gas Managers Association to drop the carpet-bagging, commercial-drummer style—it's not good engineering.

Yours, etc.,
ENGINEER.

Gas Engines.

OFFICE OF VINCENNES GAS LIGHT CO.,
VINCENNES, IND., Dec. 28, 1881.

To the Editor AMERICAN GAS LIGHT JOURNAL:

The following statement of the cost and performance of his engine was furnished to a newspaper, making inquiry, by Mr. R. E. Purcell, Editor and Proprietor of the Vincennes *Daily and Weekly Sun*. In addition, he states—

"The engine has never once, in the almost three years we have used it, failed to do, promptly and satisfactorily, the work required of it, and has never cost me one cent for repairs. I could not possibly do without it."

Statement of labor performed by Gas Engine, and cost of same, in the Daily Sun Office Nov. 1st, 1880, to Nov. 1st, 1881.

Number of Daily issued during year	125,000
" " Weekly " "	110,000
" " impressions equal to job work done	25,000
Total	260,000

Cost of Gas in 1880.

November	$1.25	December	$1.25

Cost of Gas in 1881.

January	$1.00	February	$1.25
March	1.25	April	1.25
May	1.50	June	1.75
July	1.25	August	1.25
September	1.00	October	1.25

Total cost one year	$15.25
" per day	0487
" per impression	00005

Engine, 1½-horse power; price of gas per 1000 cubic feet, $2.50.

GEO. G. RAMSDELL.

ANTIQUE BRONZE.—Dissolve one ounce sal ammoniac, 3-ozs. cream tartar and 6-ozs. common salt in one pint of hot water; add 2-ozs. nitrate of copper dissolved in half pint of water; mix well and by means of a brush, apply it repeatedly to the article, which should be placed in a damp situation,

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.

(with W B Scott & Co.,)

34 Pine Street, New York City.

February 16, 1882.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central	$466,000	50	70	75
Harlem	1,800,000	50	94	97
" Bonds	170,000			103
Manhattan	4,000,000	50	233	238
Metropolitan	2,500,000	100	167	170
" Bonds	658,000	..	107	110
Mutual	5,000,000	100	99	102
" Bonds, go'd.	900,000	1000	100	104
Municipal	1,500,000	100	203	206
" Bonds	750,000		106	110
New York	4,000,000	100	124	126
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	114	118
Citizens	1,200,000	20	57	62
" S. F. Bonds.	320,000	1000	105	109
Fulton Municipal	1,500,000	100	70	75
Peoples	1,000,000	10	30	35
" Bonds	290,000	.	101	104
" "	250,000	...	70	75
Metropolitan	1,000,000	100	60	65
Nassau	1,000,000	25	60	64
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	70	75
" Bonds	1,000,000	...	98	103
Richmond Co., S. I.	300,000	50	70	75
" Bonds	40,000	—	—	—
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			38	39
Bonds			107	—
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
Jersey City	750,000	20	155	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo.	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	159	160
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	75	80
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Wilmington, Del.		50	174	...
Yonkers		50	30	32
St. Louis Missouri	600,000	50	250	254
San Francisco Gas Co., S. Fr'isco Cal.			68	69
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	185	200
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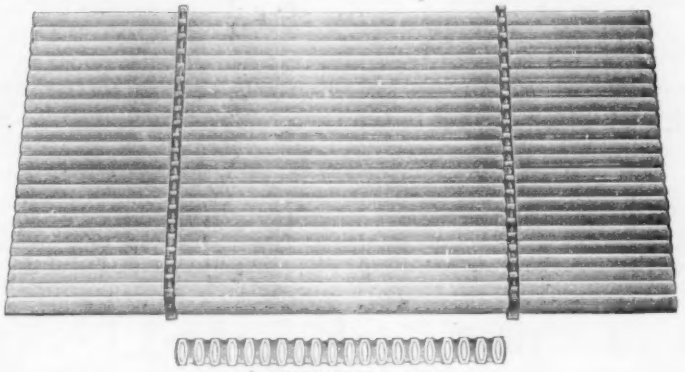

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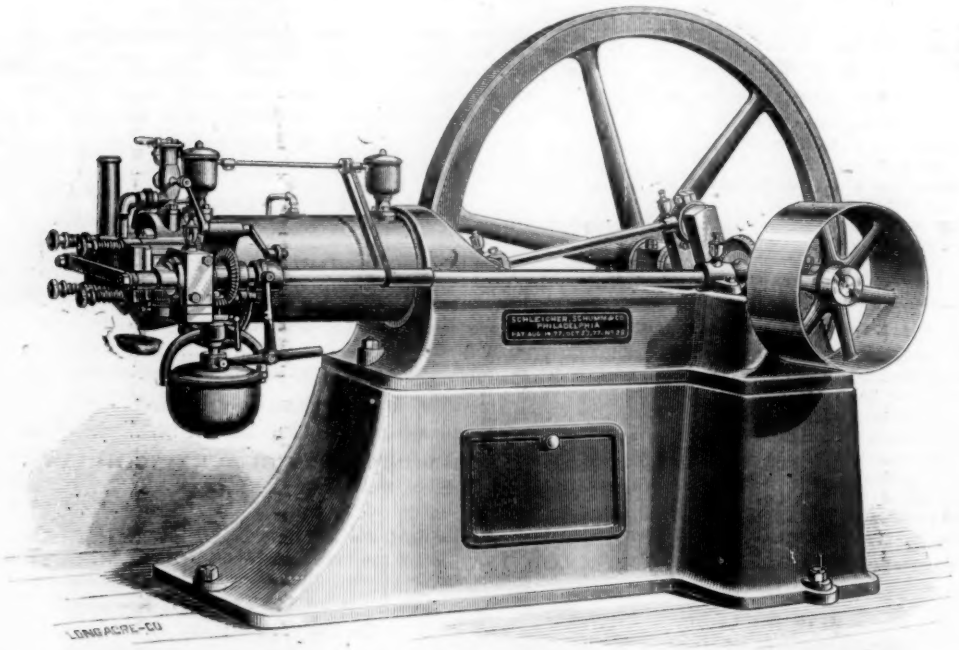

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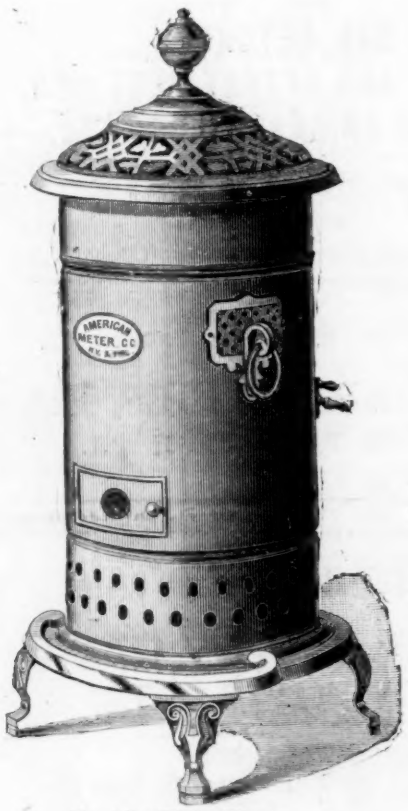

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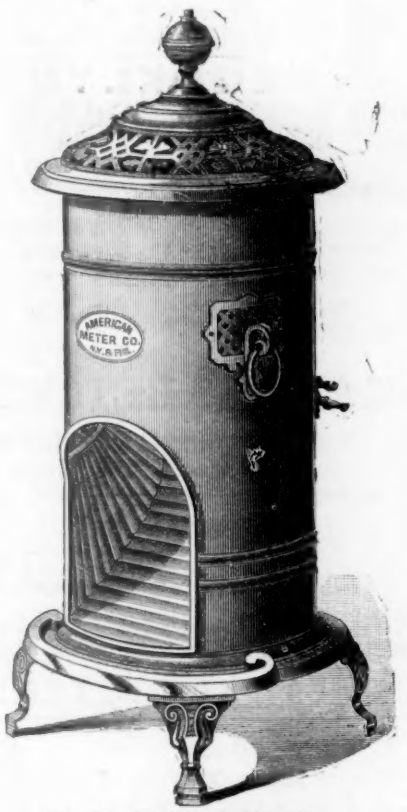

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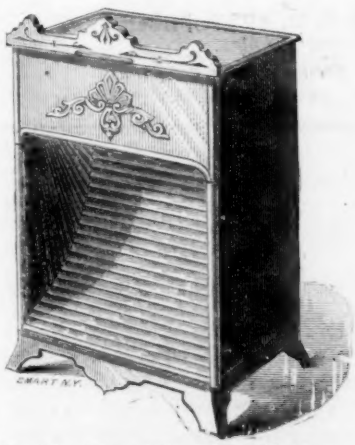

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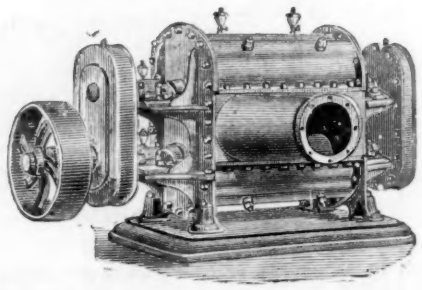

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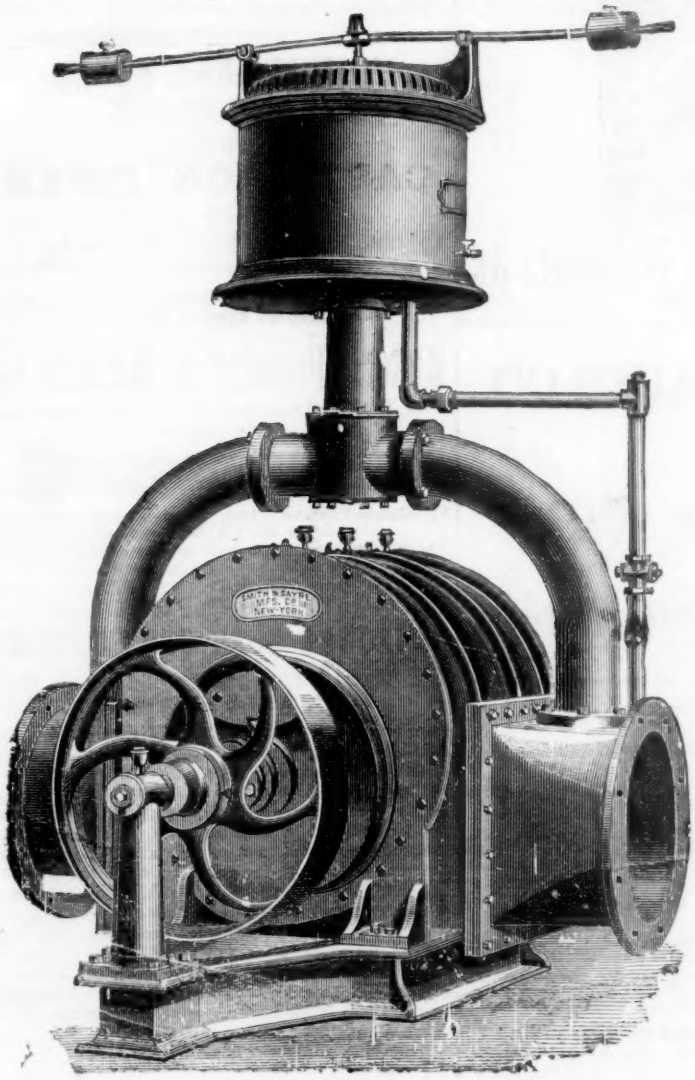

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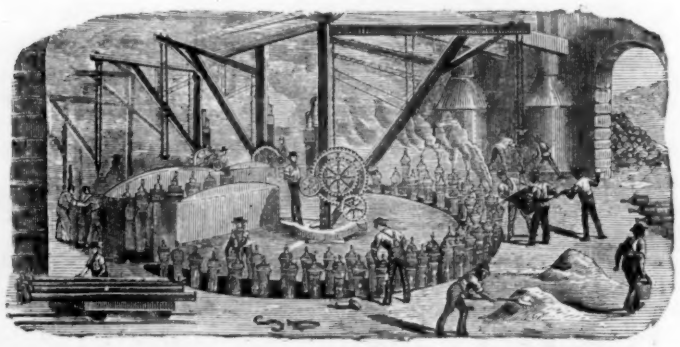

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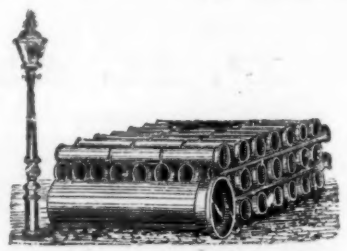

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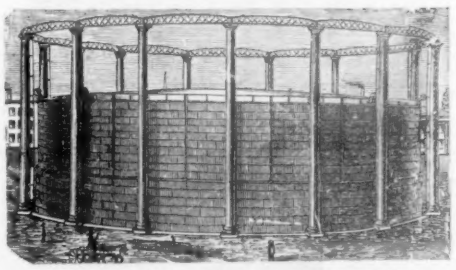
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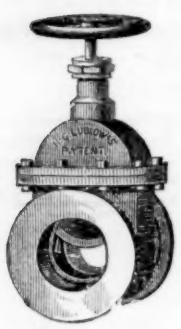

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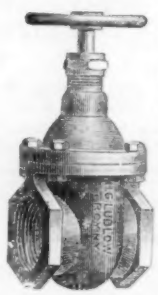

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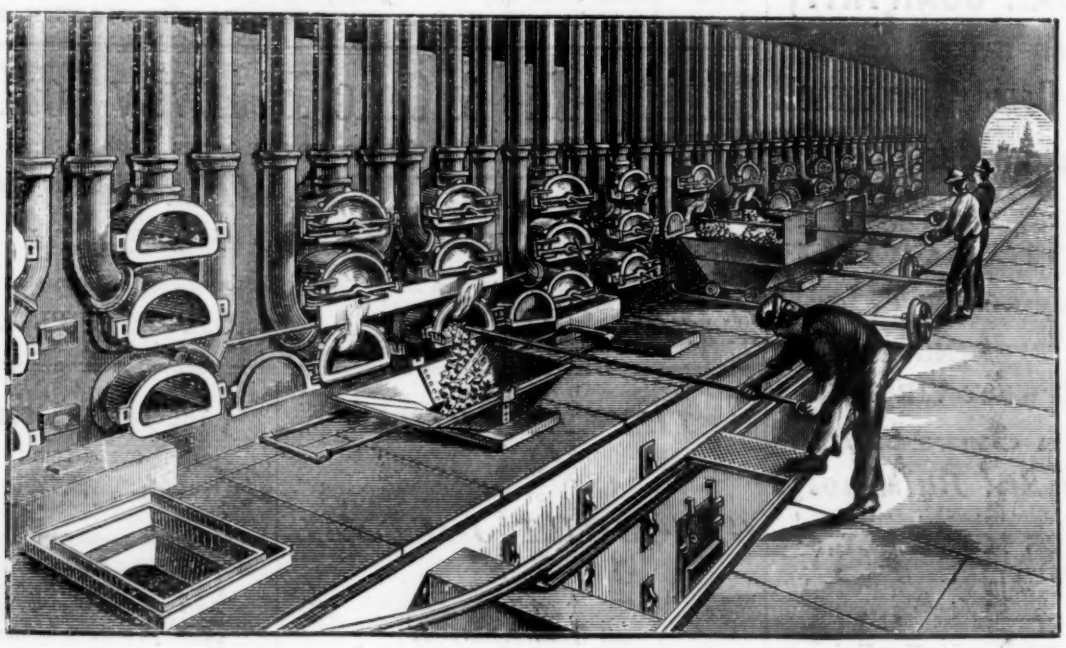

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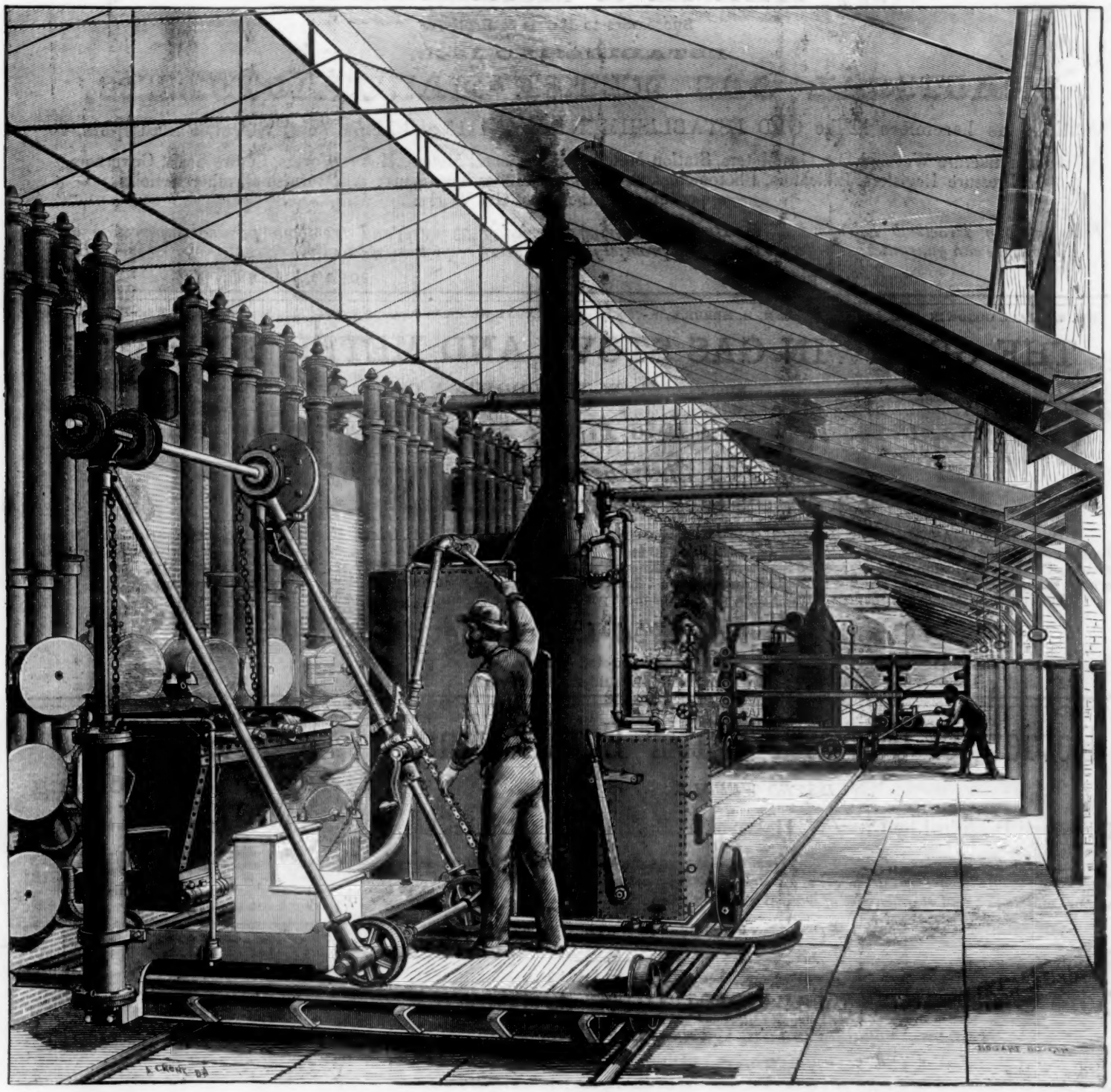

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